

EXHIBIT 8

Expert Report of
Dr. Charles A. Scherbaum

EEOC v. Schuster Co.

Civil Action No: 5:19-CV-4063 (N.D. Iowa)

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Executive Summary

I have been retained by the Equal Employment Opportunity Commission in the matter *Equal Employment Opportunity Commission v. Schuster Co.* (Civil Action No: 5:19-CV-4063, N.D. Iowa). I have been asked to offer professional opinions about the use of a physical ability test by the Schuster Company (“Schuster”) as part of their employee selection process for truck drivers and the validation report for this selection procedure prepared by Dr. Chester Hanvey on behalf of Schuster.

Schuster implemented a new physical ability test as part of their employee selection process for truck drivers in June 2014 to replace an existing physical ability test that had been used for many years. The new test, developed by Cost Reduction Technologies (“CRT”), is an isokinetic physical ability test which measures the amount of force applied by an individual throughout a range of motion. Truck drivers who have received a conditional offer of hire must take the CRT test at new driver orientation. The test is used in a pass/fail manner and drivers who fail the CRT test have their conditional offers of hire revoked. The EEOC has found that Schuster’s use of the CRT test creates a substantial adverse impact against female conditional hires for truck driver positions. In response to the findings of adverse impact, Schuster engaged Dr. Hanvey to conduct validation research to attempt to demonstrate the job-relatedness of the CRT test for making employee selection decisions. Additionally, Dr. Hanvey gathered measurements of the physical force required to perform the physically demanding tasks of the job in an attempt to justify the current strength classification of the Schuster truck driver job which is the basis for passing score on the CRT test.

In his report, Dr. Hanvey put forth three different sources of evidence to support his opinion that the CRT test used at Schuster is valid and job related. First, he argues that the existing scientific literature, in general, supports the validity of isokinetic tests for selecting employees. Second, Dr. Hanvey argues that validity evidence from another company using the CRT test can be transported to Schuster. Third, Dr. Hanvey conducted a local criterion-related validation study at Schuster. He argues that the results support the validity of the CRT test at Schuster. Additionally, Dr. Hanvey conducted an analysis of the physically demanding tasks of the truck driver job at Schuster and concludes that the current passing score on the CRT test is appropriate and in line with the demands of the job.

My review of the validity evidence offered by Dr. Hanvey finds that it does not meet the standards described in the *Uniform Guidelines for Employee Selection Procedures*, the Society for Industrial and Organizational Psychology’s *Principles for the Validation and Use of Employee Selection Procedures*, and the *Standards for Educational and Psychological Tests* from the American Educational Research Association, American Psychological Association, and National Council on Measurement in Education.¹ The validity evidence contains a number of

¹ Equal Employment Opportunity Commission, Civil Service Commission, Department of Labor, & Department of Justice. (1978). Adoption by four agencies of Uniform Guidelines on Employee Selection Procedures. *Federal Register*, 43, 38290-38315. 32.

SIOP (2018). *Principles for the validation and use of personnel selection procedures*. Bowling Green: SIOP. American Educational Research Association, American Psychological Association, National Council on Measurement in Education, Joint Committee on Standards for Educational, & Psychological Testing (2014). *Standards for educational and psychological testing*. American Educational Research Association.

foundational flaws that lead me to the conclusion that there is **no evidence of the job-relatedness** of the CRT test for truck driver positions at Schuster. I also find that evidence presented by Dr. Hanvey does not support the use of the current passing score on the CRT test used by Schuster. Several of the most important flaws are summarized below. Greater detail and additional points are found in the balance of my report:

- 1) The scientific research contains little support for using isokinetic tests to select employees. In fact, many of the sources from the scientific literature that Dr. Hanvey cites in his report explicitly state there is limited support for isokinetic tests. The scientific literature that Dr. Hanvey relied on refers to a completely different type of physical ability test. Dr. Hanvey focuses on workers' compensation costs as an outcome for validating the CRT test. The scientific literature provides no evidence that isokinetic tests are valid predictors of workers' compensation costs. Taken together, the scientific literature provides no basis for arguing that an isokinetic test is a valid selection procedure at Schuster.
- 2) The attempts to transport validity evidence from another company using the CRT test to Schuster fails to meet any of the requirements described in *Uniform Guidelines* as necessary for transporting validity evidence from one company to another. The most foundational requirements are (1) the evidence clearly shows the validity of the selection procedure at the other company and (2) an analysis of the job at each company demonstrating the similarity of the major work behaviors. Dr. Hanvey does not establish either of these requirements and therefore cannot argue for the transportability of validity evidence to Schuster.
- 3) The local criterion-validation study conducted by Dr. Hanvey provides no evidence of validity for the CRT test at Schuster. The study includes no analysis showing a relationship between the CRT test and important work behaviors or outcomes at Schuster. His validity claim rests solely on the "visual inspection" of a graph of workers' compensation costs before and after the new physical ability test was implemented. This evidence is insufficient to support a claim of validity. A closer look at the data shows that injuries and workers' compensation costs actually increase after the new physical ability test was implemented and there are many easily identified alternative explanations for the pattern that Dr. Hanvey claims to observe in the data.
- 4) Even if an analysis of the relationship between the CRT test and workers' compensation costs had been presented, it would not be interpretable. The data suffer from a number of credibility problems including a lack of agreement between CRT and Dr. Hanvey on which data are relevant to include and the presence of a large number of contaminating factors that are not job related and not related to physical abilities. Dr. Hanvey did not recognize or adequately address most of these problems.
- 5) The attempts to justify Schuster's passing score on the CRT test involved physical force measurements taken by Dr. Hanvey while he personally performed the physically demanding tasks of the job. Measures of the physical force applied while performing these tasks that come from a single individual who is male and not a truck driver at

Schuster could never justify the passing score used by Schuster. All these measurements tell us is how much force Dr. Hanvey applied when he performed the tasks. It does not indicate how much force is actually required to perform them. Moreover, no female truck drivers were observed performing these tasks and no physical force measurements were taken from female truck drivers. The scientific research literature has found that men and women can perform physically demanding tasks differently and that women can perform them using less physical force. The exclusion of female truck drivers from the job observations and measurement of physical force required to perform the physically demanding tasks of the job completely undermines any claim about the appropriateness of the passing score on the physical ability test.

For these and other reasons described below, there is **no** evidence of the validity or job-relatedness of the physical ability test used by Schuster.

Expert Qualifications

Dr. Charles A. Scherbaum received his M.S. and Ph.D. in industrial and organizational psychology from Ohio University. He earned a B.S. in psychology from the University of Washington.

Dr. Scherbaum is a tenured and full professor of industrial and organizational psychology at Baruch College, City University of New York. He teaches courses at the undergraduate, masters, executive, and doctoral levels on employee selection, performance management, research methods, statistics, and psychometrics. He is the director of the Ph.D. program in industrial and organizational psychology at the City University of New York.

Dr. Scherbaum is an expert on employee selection procedures, statistical methods, and test validation. His research on these topics has appeared in peer-reviewed journals such as *Personnel Psychology*, *Organizational Research Methods*, *Educational and Psychological Measurement*, *Human Resource Management Review*, *Industrial and Organizational Psychology*, and *Personnel Assessment and Decisions*. He has authored a book on statistical methods published by Sage and authored many chapters in edited books. He has made over 140 invited and peer-reviewed presentations at national and international professional meetings and conferences on topics including employee selection procedures, test validation, and psychometric methods.

Dr. Scherbaum is on editorial boards of the top peer-reviewed journals in industrial and organizational psychology including the *Journal of Applied Psychology*, *Organizational Research Methods*, *International Journal of Selection and Assessment*, *Journal of Business and Psychology*, *Industrial and Organizational Psychology: Perspectives on Science and Practice*, and *Personnel Assessments and Decisions*.

Dr. Scherbaum was one of the winners of the 2011 M. Scott Myers Award for Applied Research in the Workplace and the 2018 Adverse Impact Reduction Research Initiative and Action Award from the Society for Industrial and Organizational Psychology for his work on cognitive ability testing and test validation. He was also one of the winners of the 2011 and 2017 Innovations in Assessment Award from the International Personnel Assessment Council for his work on cognitive ability testing and test validation.

Dr. Scherbaum has worked with a variety of organizations in the public and private sector conducting job analyses and developing and validating selection procedures for jobs ranging from truck drivers to school principals to accountants to NFL players. He has served as an expert in both active litigation and settlement agreements involving employment discrimination over the past five years. He has worked as an expert for the United States Department of Justice and the Equal Employment Opportunity Commission. A list of cases where Dr. Scherbaum was involved as an expert along with his scholarly contributions are included in his vita which is attached as Appendix A. His billing rate for expert services in this case is \$250 per hour.

Background

I have been retained by the Equal Employment Opportunity Commission (“EEOC”) in the matter Equal Employment Opportunity Commission v. Schuster Co. (Civil Action No: 5:19-CV-4063, N.D. Iowa). I have been asked to offer professional opinions about the use of a physical ability test by the Schuster as part of their employee selection process for truck drivers and the validation report for this selection procedure prepared by Dr. Chester Hanvey on behalf of Schuster.

This case involves a physical ability test that Schuster uses as part of its employee selection process for truck drivers. Truck drivers who have received a conditional offer of hire must take a physical ability test at new driver orientation. The test is used in a pass/fail manner and drivers who fail the physical ability test have their conditional offers of hire revoked. The physical ability test used by Schuster is called an isokinetic test. An isokinetic test “measures the amount of force a person can produce throughout an entire range of motion.”² Isokinetic tests measure what is called dynamic strength. Dynamic strength is the ability to exert muscle force repeatedly over time and involves muscular endurance and resistance to fatigue. Isokinetic testing uses specialized equipment that resembles weight machine equipment found at a gym. The isokinetic test used at Schuster was developed by Cost Reduction Technologies (“CRT”).

The CRT isokinetic test is claimed to identify individuals who are at risk of musculoskeletal disorder (“MSD”) injuries. According to the Centers for Disease Control (“CDC”) and the Bureau of Labor Statistics (“BLS”), MSD injuries can be defined as,

“... musculoskeletal system and connective tissue diseases and disorders when the event or exposure leading to the case is bodily reaction (e.g., bending, climbing, crawling, reaching, twisting), overexertion, or repetitive motion. MSDs do not include disorders caused by slips, trips, falls, or similar incidents.”^{3, 4}

Prior to implementing the CRT test, Schuster was using an alternative physical ability test that involved equipment that simulated some of the physically demanding tasks such as turning a crank to lower the landing gear of the trailer and lifting objects.⁵

The CRT isokinetic test is administered by a trained administrator. All conditional hires complete the CRT test under standardized conditions. The process involves multiple repetitions of five different motions. There is a motion involving the right shoulder/arm, left shoulder/arm, right leg/knee, left leg/knee, and trunk. Only the attempt with the maximum force is used in computing the score on the test. The overall score is called a Body Index Score (“BIS”) by CRT.

² CRT Isokinetic Test Manual.

³ [https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html#:~:text=Musculoskeletal%20disorders%20\(MSD\)%20are%20injuries,to%20the%20condition%3B%20and%20For](https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html#:~:text=Musculoskeletal%20disorders%20(MSD)%20are%20injuries,to%20the%20condition%3B%20and%20For)

⁴ In his report, Dr. Hanvey notes that he relied on the BLS definition in footnote #68. That definition can be found at: <https://www.bls.gov/iif/oshdef.htm>. The CDC clarifies that injuries caused by slips, trips, or falls are not MSD injuries in the BLS definition. Dr. Hanvey does not clarify how he treated slips, trips, and falls.

⁵ Schuster Deposition, p. 33 #15.

Arens Deposition, p. 54 #22- p. 55 #9.

In simple terms, the score is

Redacted

⁶ At Schuster, conditional hires need to achieve a BIS of 151 to pass the CRT test. At present, those who fail the CRT test have their conditional hire revoked. However, they can re-take the test at their own expense (\$200).

The EEOC has found that this selection procedure has an adverse impact against female conditional hires for truck driver positions at Schuster. The EEOC's labor economist, Dr. George, found statistically significant differences in the passing rates for males and females. Dr. George found a shortfall of 20 female truck drivers passing the CRT test at Schuster than what would be expected.⁷ In response to the findings of adverse impact, Schuster engaged Dr. Hanvey to conduct validation research to attempt to demonstrate the job-relatedness of the CRT test for making employee selection decisions and to justify the current passing score on the CRT test.

To demonstrate the job relatedness, one or more sources of validity evidence are needed. Professional standards such as the *SIOP Principles* or the *APA Standards*, define validity as,

“the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests.” (p. 5)⁸

There are many different strategies or sources of information identified in the *Uniform Guidelines* or *SIOP Principles* that can be used to generate validity evidence. These include:

- **Construct validity** – The *Uniform Guidelines* define as: “Evidence of the validity of a test or other selection procedure through a construct validity study should consist of data showing that the procedure measures the degree to which candidates have identifiable characteristics which have been determined to be important in successful performance in the job for which the candidates are to be evaluated.” (Section 5B)⁹
- **Content validity** – The *Uniform Guidelines* define as: “Evidence of the validity of a test or other selection procedure by a content validity study should consist of data showing that the content of the selection procedure is representative of important aspects of performance on the job for which the candidates are to be evaluated.” (Section 5B)¹⁰
- **Criterion-related validity** – The *Uniform Guidelines* define as: “Evidence of the validity of a test or other selection procedure by a criterion-related validity study should consist of empirical data demonstrating that the selection procedure is predictive of or significantly correlated with important elements of job performance.” (Section 5B)¹¹
- **Validity generalization from the scientific literature** – The *Uniform Guidelines* and *SIOP Principles* do not explicitly define this strategy. However, the *SIOP Principles* acknowledge that cumulative validity evidence from the scientific literature (in the form of a meta-analysis) can be generalized.

⁶ In technical terms, the score is

Redacted

⁷ Expert Report of Dr. Erin George.

⁸ SIOP (2018).

⁹ EEOC (1978).

¹⁰ EEOC (1978).

¹¹ EEOC (1978).

- **Validity transportability** – The *SIOP Principles* define as: “One approach to generalizing the validity of inferences from scores on a selection procedure involves the use of a specific selection procedure in a new situation, based on results of a validation research study conducted elsewhere. When these research findings are determined to be applicable to a current selection situation due to a preponderance of key observable and/or underlying similarities with other validity evidence, this is referred to as demonstrating the “transportability” of that evidence.” (p. 33).¹²

There can be instances where only when one source of evidence is presented because the evidence is compelling. An example would be where there is criterion-related validity evidence showing a statistically significant correlation between scores from a selection procedure and scores on a measure of important work behaviors or outcomes. There can also be instances where multiple forms of validity evidence are presented. This can occur by design (e.g., a validation study planned to collect content and criterion-related validity evidence) or when the available sources of validity evidence contain flaws (e.g., sample sizes are too small to permit statistical analysis, analysis is not statistically significant, insufficient job analysis information). In the latter case, it is usually argued that collectively the sources of validity evidence overcome the flaws of each individual source and allow for overall inferences that the selection procedure is valid.

This latter case reflects the validity evidence offered by Dr. Hanvey where multiple strategies are presented because the criterion-related validity is flawed and insufficient. In his report, Dr. Hanvey put forth three different sources of evidence to support his opinion that the CRT test used at Schuster is valid and job related. First, he argues that the existing scientific literature, in general, supports the validity of isokinetic tests for selecting employees. Second, Dr. Hanvey argues that validity evidence from another company using the CRT test can be transported to Schuster. Third, Dr. Hanvey conducted a local criterion-related validation study at Schuster. He argues that the results support the validity of the CRT test at Schuster for truck drivers. Additionally, Dr. Hanvey conducted analysis of the physically demanding tasks of the truck driver job at Schuster and concludes that the current passing score on the CRT test is appropriate and in line with the demands of the job.

My review of the validity evidence offered by Dr. Hanvey finds that it does not meet the standards described in the *Uniform Guidelines* and the *SIOP Principles* for concluding a selection procedure is valid. Each source of validity evidence contains fundamental flaws. The combination of sources of validity evidence cannot overcome the fundamental flaws in each source. In his chapter on validity pitfalls in Dr. Hanvey’s book, Dr. Rich Tonowski notes that a common pitfall is trying to save a local criterion-related validity study that fails to find validity evidence by arguing for generalized validity evidence from other sources.¹³ That is the case here. Therefore, my conclusion is that there is **no evidence of the job-relatedness** of the CRT test used by Schuster for truck driver selection and the passing score is not justified. The following sections outline the basis of this opinion. A list of the documents and information sources used in preparing this report can be found in Appendix B.

¹² SIOP (2018).

¹³ Tonowski, R. (2015). Test validation pitfalls. In C. Hanvey & K. Sady (Eds.) *Practitioner's Guide to Legal Issues in Organizations* (pp. 49-83). Springer.

The Scientific Research Literature Contains Little Support the Use of Isokinetic Test for Selecting Employees

The first of Dr. Hanvey's three sources of validity evidence is the existing scientific research literature. I agree with Dr. Hanvey that existing validity evidence from the scientific research literature is and should be part of judgements about the validity evidence for a selection procedure. Professional practice standards do allow for inferences of validity from the existing evidence to a given setting in some situations. As the *SIOP Principles* state,

“An important consideration in many validation efforts is whether sufficient validity evidence already exists to support the proposed uses.....Existing evidence provides informational value when it establishes a statistical relationship and supports the generalization from the validation setting to the operational setting. When such evidence has been accumulated, it may provide a sufficient rationale for inferring validity in the operational setting and may support a decision not to gather additional evidence. Such inferences depend on evidence of validity rather than mere claims of validity.” (p. 10).¹⁴

As further described in the *SIOP Principles*, one must consider a variety of different factors to determine whether generalizing existing validity evidence from the scientific literature to a specific setting is appropriate. These factors include the similarity between the given situation and existing evidence in terms of the types of tests, types of criteria, types of employees, and types of jobs to name a few examples. In one of the few peer-reviewed papers to attempt to generalize validity evidence for a physical ability test from the scientific literature to a specific setting, Hoffman states that he can make generalizations from the literature only because the test is the same, the criterion is the same, and the job is the same. He needed all three to be the same to make the generalization.¹⁵

My review of scientific literature on physical ability tests indicates that it **does not** support inferences that the CRT isokinetic test is valid for employee selection decisions for truck drivers at Schuster. As I describe, the scientific literature offers little support for the type of test used at Schuster, little support for the criterion of workers' compensation used by Dr. Hanvey, and little of the research examined truck drivers. The necessary conditions to generalize the validity evidence from the scientific literature are not present.

The “strong support” from the scientific literature described by Dr. Hanvey does not apply to isokinetic physical ability tests, but to a different type of physical ability test called an isometric test. The scientific literature has identified three basic types of physical ability tests (i.e., isometric, isotonic, and isokinetic).¹⁶ The differences between the tests involve the amount and type of muscle contraction.¹⁷ Isometric tests assess the amount of force applied without movement. An example isometric test would be an arm lift, leg lift, or shoulder lift. The

¹⁴ SIOP (2018).

¹⁵ Hoffman, C. C. (1999). Generalizing physical ability test validity: a case study using test transportability, validity generalization, and construct-related validation evidence. *Personnel Psychology*, 52(4), 1019-1041.

¹⁶ Isotonic testing involves measuring the force applied though a range of movement at a specific joint (e.g., a bench press) and have been found to be predictive of performance in public safety jobs (Gebhardt & Baker, 2010a).

¹⁷ Blakley, B. R., Quiñones, M. A., Crawford, M. S., & Jago, I. A. (1994). The validity of isometric strength tests. *Personnel Psychology*, 47, 247-274.

scientific literature finds evidence of the validity of isometric tests for job performance criteria such as supervisor rating and performance tests.¹⁸ Despite the intuitive appeal of using physical ability tests for reducing injuries, the evidence supporting the link between physical ability tests (of any kind) and injuries or workers' compensation costs is much more limited than one would assume. As is explained below, the scientific literature is insufficient to support the generalizations that Dr. Hanvey is attempting to make.

As described by Hoffman, a generalization of validity from the scientific literature to Schuster would require that there is a match of the same test, same criterion, and same job between the literature and Schuster.¹⁹ These matches do not exist in this case. The evidence in support of isometric tests cannot simply be generalized to isokinetic tests as Dr. Hanvey attempts to do.

There is actually very little research showing that scores on isokinetic tests are related to job performance or injuries. In 1998, Gallagher and colleagues concluded there was little support for the validity of isokinetic testing at that time.

“The ability of isokinetic muscle testing to predict risk of future injury or illness has not yet been demonstrated. Thus far, prospective studies have shown that generic isokinetic strength tests (like generic static strength tests) do not predict those who might experience low back pain. Whether isokinetic strength tests can be used to predict injury or illness when careful comparisons of job demands and individual strength capabilities are performed has not yet been investigated.” (p. 54)²⁰

Twenty-two years later, Gebhardt and Baker note:

“There is limited published research using isokinetic testing in an occupational setting. However, some research has shown a relationship between isokinetic test scores and injury reduction (Gilliam & Lund, 2000; Karwowski & Mital, 1986).” (p. 282)²¹

Dr. Hanvey cites this specific chapter repeatedly as support for his opinion. It clearly does **not** support his claims. This chapter is unambiguous in stating that there is **not** strong evidence of the job-relatedness of isokinetic tests. A close examination of the two papers supposedly supporting isokinetic tests finds that they are not credible sources of support as they do not show that isokinetic tests are associated with reduced injuries. The Karwowski and Mital paper does not examine injuries.²² It compares isometric and isokinetic tests on their correspondence to actual

¹⁸ Arvey, R. D., Landon, T. E., Nutting, S. M., & Maxwell, S. E. (1992). Development of physical ability tests for police officers: A construct validation approach. *Journal of Applied Psychology*, 77, 996–1009.

Blakley et al. (1994).

Gebhardt, D. L., & Baker, T. A. (2010a).

Gebhardt, D. L., & Baker, T. A. (2010b).

¹⁹ Hoffman, C. C. (1999).

²⁰ Gallagher, S., Moore, J. S., & Stobbe, T. J. (1998). *Physical Strength Assessment in Ergonomics*. AIHA Press: Fairfax, VA.

²¹ Gebhardt, D. L., & Baker, T. A. (2010a).

²² Karwowski, W. & Mital, A. (1986). Isometric and isokinetic testing of lifting strength of males in teamwork. *Ergonomics*, 29, 869-878.

exertion on physical tasks. They conclude that isometric tests are better. The Gilliam and Lund citation is a conference abstract about a paragraph in length, not a peer reviewed journal article.²³ This hardly constitutes strong support for the validity of isokinetic tests for predicting injuries or workers' compensation costs.

The other papers that Dr. Hanvey draws support from reach similar conclusions. In fact, Rosenblum and Shankar state that there were only a very small number of studies of any importance that predict future injury from isokinetic tests as of 2006.²⁴ Rosenblum and Shankar is the only substantial peer reviewed paper showing that isokinetic tests are related to injuries at work. A search of papers published between 2006 and 2020 citing Rosenblum and Shankar produces no additional peer reviewed papers examining isokinetic tests and injuries/workers' compensation costs. The chapter on physical abilities in Dr. Hanvey's edited book claims that additional studies exist, but no details or citations to those studies are provided.²⁵

In fact, the scientific literature seems to suggest the usefulness of isokinetic tests is limited as they are generally less representative of physically demanding job tasks (i.e., they are not content valid). Gallagher and colleagues question the ultimate usefulness for these tests in the workplace.

“However, such devices may be limited in their ability to assess occupational demands at the workplace. This is because isolated joint or segment strengths may be unrelated to a person's ability to perform a specified occupational task. For example, the ability to perform a lifting task may be unrelated to isokinetic trunk strength; rather, the ability to perform such a task may be limited by strength capabilities of other muscle groups (such as those of the arms or legs).” (p. 54).²⁶

Twenty years later, Anderson and Briggs in describing why they did not use isokinetic testing in their research raise the same point.

“One of the reasons for this choice was the emphasis placed in the Uniform Guidelines on Employee Selection Procedures and technical assistance manuals for the Americans with Disabilities Act on the representativeness of the test to what is actually done on the job.” (p. 32).²⁷

Contrary to the claims of Dr. Hanvey, the scientific literature offers very little validity evidence in support of isokinetic tests. Thus, Dr. Hanvey's validity argument that the scientific literature supports the use of the CRT test at Schuster has no merit.

²³ Gilliam, T., & Lund, S. J. (2000). Injury reduction in truck driver/dock workers through physical capability new hire screening. *Medicine Science in Sports and Exercise*, 32, S126.

²⁴ Rosenblum, K. E., & Shankar, A. (2006). A study of the effects of isokinetic pre-employment physical capability screening in the reduction of musculoskeletal disorders in a labor intensive work environment. *Work*, 26(2), 215-228.

²⁵ Murphy, K.R. (2015). Physical abilities. In C.M. Hanvey and K.G. Sady (Eds.), *Practitioner's Guide to Legal Issues in Organizations* (pp. 111-126). New York, NY: Springer.

²⁶ Gallagher et al. (1998).

²⁷ Anderson, C. & Briggs, J. (2008). A study of the effectiveness of ergonomically-based functional screening tests and their relationship to reducing worker compensation injuries. *Work*, 31, 27-27.

The Validity Transportability Claim Fails to Meet the *Uniform Guidelines* Requirements

The second of Dr. Hanvey's three sources of validity evidence is data from another company that participated in a validation study of the CRT test. Dr. Hanvey argues that the validity evidence from the other company can be transported to Schuster "provided that certain conditions are met."²⁸ The *Uniform Guidelines* Question and Answers describe the conditions that need to be met for transportability in Question 66.

"66. Q. Under what circumstances can a selection procedure be supported (on other than an interim basis) by a criterion-related validity study done elsewhere?

A. A validity study done elsewhere may provide sufficient evidence if four conditions are met (Sec. 7B):

1. The evidence from the other studies clearly demonstrates that the procedure was valid in its use elsewhere.
2. The job(s) for which the selection procedure will be used closely matches the job(s) in the original study as shown by a comparison of major work behaviors as shown by the job analyses in both contexts.
3. Evidence of fairness from the other studies is considered for those groups constituting a significant factor in the user's labor market. Section 7B(3). Where the evidence is not available the user should conduct an internal study of test fairness, if technically feasible. Section 7B(3).
4. Proper account is taken of variables which might affect the applicability of the study in the new setting, such as performance standards, work methods, representativeness of the sample in terms of experience or other relevant factors, and the currency of the study."

As I describe, Dr. Hanvey's validity transportability argument has no merit. He does not establish that these conditions have been met. Professional practice guidelines are clear that Dr. Hanvey's attempt to transport validity are insufficient.²⁹ Even DCI Consulting warned against using their validation study in the way that Dr. Hanvey attempts to do.³⁰ Therefore, it is not possible to transport any validity evidence that may exist.

Condition #1: Validity evidence exists elsewhere

In order to meet condition #1, there needs to be a clear demonstration of validity at a different company. Dr. Hanvey attempts to transport the validation evidence from an unidentified "Company A" in a criterion-related validity study conducted by DCI Consulting on behalf of CRT. The *Uniform Guidelines* describe what would be required of a criterion-related validity study in order to argue that the CRT test is valid elsewhere:

²⁸ Hanvey Report, p. 30.

²⁹ Gibson, W. M., & Caplinger, J. A. (2007). Transportation of validation results. In S. M. McPhail (Ed.), *Alternative validation strategies: Developing new and leveraging existing validity evidence*. (pp. 29–81). Hoboken, NJ: Wiley.

³⁰ DCI000243.pdf

“Evidence of the validity of a test or other selection procedure by a criterion-related validity study should consist of empirical data demonstrating that the selection procedure is predictive of or significantly correlated with important elements of job performance.” (Section 5B)³¹

The *SIOP Principles* state:

“Evidence for criterion-related validity typically consists of a demonstration of a relationship between the scores on a selection procedure (predictor) and one or more measures of work-relevant behavior or work outcomes (criteria).” (p. 14)

A careful review of the validity study that Dr. Hanvey uses as the basis of his validity transportability argument shows that it does not demonstrate that the CRT test is valid elsewhere. That study included two trucking companies. The study attempted to show that after each company implemented the CRT test as part of the hiring process, the number of injuries decreased.

One of the two companies was Schuster (“Company B” in the study). However, the data from Schuster included a very small number of MSD injuries and was seen by DCI Consulting and Dr. Hanvey as contributing too little data to support inferences about the validity of the test at Schuster.³² Also, the results varied substantially depending on whether the MSD injuries identified by CRT or the MSD injuries identified by DCI Consulting were included in the analysis. This is a problem that I describe in more detail in the following sections.

While the other company contributed more data to analyze than Schuster, there is still no criterion-related evidence to support a claim of validity. The results supposedly show that there are fewer injuries at the company after implementing the CRT test. Based on this supposed difference in injuries before and after the CRT test was implemented, DCI Consulting claims that there is validity evidence for the CRT test. This is an indirect and circumstantial demonstration of the validity of the CRT test. There is no direct demonstration showing that those with higher scores on the CRT test are less likely to be injured or more effective at the job. This is the expected evidence to support a claim of validity evidence from a criterion-related validity study.

The conclusions for the validity evidence hinge on a large number of assumptions that are not tested or verified by DCI Consulting. For example, because the validity evidence involves comparing injuries that occurred at two different points in time, one must establish that there are no other possible reasons for the changes. DCI Consulting did not report any attempts to identify or rule out other possible reasons that could explain the pattern they claim to observe. This is a major flaw in the validity evidence and limits any conclusions about the validity of the CRT test. As I describe in a following section, there are a large number of alternative explanations in the time frames that were not examined in the DCI Consulting validation study. These alternatives better explain the pattern in the data than the implementation of the CRT test. The majority of the flaws with Dr. Hanvey’s criterion-related validity study (as described below) also

³¹ EEOC (1978).

³² CRT identified three MSD injuries at Schuster. DCI Consulting identifies seven MSD injuries. Regardless of the discrepancy in the number of MSD injuries, there were too few MSD injuries for a meaningful analysis.

apply to the DCI Consulting criterion-related validity study. The flaws are substantial and rule out any inferences of validity in the DCI Consulting validation study. Therefore, condition #1 is not met.

Condition #2: Job analyses at each company demonstrated the similarity of the jobs

In order to meet condition #2, there would need to be a job analysis at both companies that provides information sufficient to compare the jobs in terms of their major work activities. The DCI Consulting validation report does not include a job analysis because one was not conducted as part of that validity study. Even the representative from DCI Consulting noted during his deposition that this would be necessary in order to transport the findings of their validation study to another company.³³ In the documents and emails available to me, DCI Consulting was concerned that others would use their validation report as evidence that the CRT test is valid in other settings without attempting to meet the conditions necessary to transport validity evidence. In other words, they were concerned that others would use their report as a “rubber stamp” of validity for the CRT test. In an email to CRT, Dr. Eric Dunleavy, a director at DCI Consulting, wrote that the concern is a client of CRT will take the DCI report as a validation study for them. He notes that the results may or may not generalize to other companies, but a transportability study would be needed to determine this.³⁴ What Dr. Hanvey is attempting with his transportability argument is exactly what DCI consulting was worried about and wanted to prevent. Dr. Hanvey did not conduct a transportability study, but is still attempting to transport the validity evidence to Schuster.

No job analysis has been produced for the unidentified “Company A” in the DCI Consulting validation report. This alone is fatal. Further, while Dr. Hanvey did conduct a job analysis at Schuster, it was limited. He considered only one type of physical ability and considered it in an overly broad way. Even if there was a job analysis from the other company, Dr. Hanvey’s job analysis would not provide the information needed to thoroughly compare the job at both companies and determine the overall similarity. Professional practice guidelines are clear that simply claiming the job at both companies is a trucking job and therefore they are the same is not sufficient to support transportability.³⁵ A much more rigorous analysis is needed to make this claim. Therefore, condition #2 is not met.

Condition #3: Evidence of the fairness of the selection procedure has been considered

In order to meet condition #3, there would need to be evidence of the fairness of the selection procedure at other companies. If that evidence is not available, then the fairness should be examined internally at Schuster. In the context of industrial and organizational psychology, one way that fairness could be established in this case is showing the test does not produce adverse impact against women or men. Another way is to show that the test is equally predictive for men and women (i.e., no predictive bias). Another way is to show that the test functions in a similar way for men and women (i.e., no measurement bias). In this context, examining the adverse impact is the most relevant. The DCI Consulting validation report presents no evidence of the

³³ CRT000134.pdf.

³⁴ DCI000243.pdf

³⁵ Gibson, W. M., & Caplinger, J. A. (2007).

fairness of the selection procedure at the other company in the CRT validation report. They do include some regression analyses predicting injury from the CRT test implementation that included gender which would be part of an examination of predictive bias.³⁶ However, the results clearly indicate that these analyses are flawed and likely did not find a solution (i.e., failed to converge).³⁷ When a regression analysis fails to find a solution, it means that statistical algorithm used in the regression analysis did not find a result that met the minimum requirements of the analysis and did not complete.³⁸ In simple terms, the results cannot be trusted because the analysis stopped before finding a final solution. The results presented are just the last attempt the analysis made to find a solution. Dr. Hanvey also presents no evidence of the fairness of the CRT test at Schuster. However, the expert report of Dr. George for the EEOC finds substantial adverse impact of the CRT test at Schuster.³⁹ Therefore, condition #3 is not met.

Condition #4: Limits to the applicability of the validity evidence have been considered

In order to meet condition #4, there would need to be a serious consideration of factors that might impact the applicability of the validity evidence from the other company to Schuster. The CRT validation report does not provide the information needed to compare Schuster to the unidentified “Company A” on variables such as performance standards, work methods, or sample characteristics which might affect the applicability of the validity evidence. The lack of information alone means condition #4 cannot be met. Moreover, based on the second deposition of Brett Crosby from CRT on 10/7/2020, the truck driver job at the other company was evaluated to have lower physical demands than the truck driver job at Schuster and used a lower passing score on the CRT test.⁴⁰ This would be a very important piece of information to consider in evaluating the transportability of any validity evidence. It is unclear if Dr. Hanvey was aware that there were lower physical demands and a lower passing score at the other company because he claims the testing programs and jobs are highly similar.⁴¹ During his deposition, Dr. Hanvey claimed the passing score at each company was not important to consider and he knew of no requirement to consider it.⁴² This position is at odds with the published literature and the statements from the experts on physical ability testing that Dr. Hanvey frequently cites.⁴³ The passing score on the CRT is based on the physical demands of the job. If the passing score is different, the physical demands are different. If the physical demands are different, the jobs are different which rules out transporting the validity evidence from the unidentified “Company A” to Schuster. Differences in the demands of the job, performance standards and work methods are considerations in evaluating condition #4 that are explicitly stated in the *Uniform Guidelines*. Therefore, condition #4 is not met.

³⁶ See Tables 14-17 of the CRT Validation Report.

³⁷ The possible lack of convergence was identified by the values of the standard error in many of the tables in the DCI Consulting validation report (e.g., table 14). The values are out of bounds of what one would expect for a model that converged. For example, in table 14 the standard error values are over 700 for some variables. These values should be closer to 1 or less.

³⁸ Allison, P. D. (2012). *Logistic regression using SAS: Theory and application*. SAS Institute.

³⁹ Expert report of Dr. George.

⁴⁰ Deposition of Brett Crosby on 10-7-20, p. 74 #21 - p. 75 #15.

⁴¹ Hanvey Report, p. 30 #65.

⁴² Hanvey Deposition p. 123 #19-#20.

⁴³ Gibson, W. M., & Caplinger, J. A. (2007).

<http://annex.ipacweb.org/library/conf/10/baker.pdf>

Given that none of the conditions outlined in the *Uniform Guidelines* have been met, the validity evidence from the other unidentified company in the DCI Consulting validation report cannot be transported to Schuster.

Dr. Hanvey's Criterion Data Are Not Credible and Are Highly Contaminated

A critical decision in a validation study is the identification of job-related criteria that are consistent with the intended use of scores from the selection procedure. There are a number of professional standards related to these decisions. These standards outline both documentation and technical requirements that apply to criteria used in validation studies. In Section 15B(5), the *Uniform Guidelines* state,

“The basis for the selection of the criterion measures should be provided, together with references to the evidence considered in making the selection of criterion measures (essential). A full description of all criteria on which data were collected and means by which they were observed, recorded, evaluated, and quantified, should be provided (essential).”

Similarly, the *SIOP Principles* state,

“Criterion validation studies, when conducted, should report the following in detail: a description of the criterion measures; the rationale for their use; the data collection procedures; and a discussion of the measures' relevance, reliability, possible deficiencies, possible sources of contamination, and freedom from or control of biasing sources of variance.” (p. 62).⁴⁴

When the criterion data reflect what are referred to as archival data (i.e., company records, company databases), one should take extra steps to ensure the data meet professional standards. As the *SIOP Principles* state,

“The growing prevalence of human resource information systems (HRISs) and other organizational data systems now make drawing on archival data as a potential source of criteria for use in validation studies increasingly viable. These archival criteria may reflect a variety of variables, such as turnover, disciplinary incidents, absenteeism, sales, customer service metrics, or engagement. Prior to using such archival data for analysis, one should take extra precautions to ensure the data are appropriate for the intended use (e.g., aligned with the work analysis, free from contamination, and acceptably reliable). In particular, the testing professional should seek to understand why the dataset exists and, if possible, test the accuracy of the archival data. Unlike data directly gathered by the team conducting the validation study, the quality of archival data is not often readily apparent. Issues surrounding the consistency of variable and value definitions over time and data owner confidence in the data are a few examples of important factors to consider.” (p. 20)⁴⁵

In terms of the nature of the criteria, both the *Uniform Guidelines* and the *SIOP Principles* are crystal clear that criterion measures should reflect performance of critical work activities and behaviors or work outcomes. In the context of validating physical ability tests, Gebhardt and Baker note,

⁴⁴ SIOP (2018).

⁴⁵ SIOP (2018).

“The most common criteria used are supervisor and/or peer ratings of job performance, productivity measures, and work samples. Injury and lost workdays are viable, but very large samples are required for use of these data. Further, injury data variables may lack variability and be confounded with other safety initiatives implemented concurrently with the testing by an organization.” (p. 286)⁴⁶

To summarize, the professional standards and the scientific research literature have identified several properties that criterion measures need to possess in order to be used in any organizational application including reliability, accuracy, free of deficiency/contamination, and reflect the behavior or outcomes that can predicted from human characteristics such as physical abilities.⁴⁷ Dr. Tonowski, in his chapter on test validation pitfalls that appeared in Dr. Hanvey’s book, captured these requirements well when he noted that criteria must be credible.⁴⁸

When the criterion is injuries or workers’ compensation costs that are acquired from company databases, the standards are higher for the criterion to be professionally acceptable. Despite the intuitive appeal of using injuries and workers’ compensation costs to validate physical ability tests, they are very challenging to use in validation studies. This is one of the reasons why there are so few peer-reviewed studies using injuries or workers’ compensation costs in validation research with physical ability tests. The challenge, in part, arises from the many subjective decisions that must be made to use these criteria. If the wrong choices are made, the credibility of the data is severely weakened. Additionally, these criteria are often highly contaminated with factors that are not job-related and not associated with physical abilities as described in the Gebhardt and Baker quote in the previous paragraph.

The criterion data used by Dr. Hanvey do not meet these professional standards. Ultimately, the criterion data are not credible and are highly contaminated. Dr. Hanvey took few steps to address these problems. The result is that these data are inappropriate to include in a validation study and any results based on them are not interpretable.

The criterion data included in the validation study are not credible

A foundational aspect of the attempts to validate the CRT test for use at Schuster is classifying the injury data into musculoskeletal disorder (“MSD”) injuries and other injuries. It is claimed that the CRT isokinetic test was designed to reduce MSD injuries. Therefore, an accurate classification of injury data is a pre-requisite of any claims of validity. Schuster’s injury data for the 2011-2016 time period have been classified by three independent groups. CRT identified three MSD injuries in this time period.⁴⁹ DCI Consulting, who conducted a validation study on

⁴⁶ Gebhardt, D. L., & Baker, T. A. (2010a).

⁴⁷ Smith, P. C. (1976). Behaviors, results, and organizational effectiveness: The problem of criteria. *Handbook of industrial and organizational psychology*, 745-775.

Murphy, K. R., & Cleveland, J. N. (1995). *Understanding performance appraisal: Social, organizational, and goal-based perspectives*. Sage.

⁴⁸ Tonowski, R. (2015).

⁴⁹ Criterion-Related Validation Study of CRT’s Isokinetic Test; CRT Validation Study.PDF

behalf of CRT, identified seven MSD injuries in this time period.⁵⁰ Dr. Hanvey and his colleague, who was also coding the injuries, disagreed on the coding of several of the injuries, but ultimately identified nine MSD injuries between 2011-2016 and an additional 11 MSD injuries between 2017-2020.⁵¹ Based on these conflicting numbers, it is not clear how many MSD injuries actually occurred at Schuster or which numbers are accurate. The test developers are the ones who could reasonably be expected to have the most knowledge about these types of injuries and they find the smallest number of them. When the CRT classifications are used, there is no statistically significant relationship between being hired before or after the implementation of the CRT test and MSD injuries at Schuster.⁵² When the DCI Consulting classifications are used, there is a statistically significant relationship between being hired before or after the implementation of the CRT test and MSDs injuries at Schuster.⁵³ Dr. Hanvey did not conduct analyses examining the relationship between being hired before or after the implementation of the CRT test and MSD injuries. Thus, any conclusions about the validity of the test hinge on who coded the injury data.

Using the injury descriptions in Exhibit 6 of Dr. Hanvey's report and considering the definition of MSD injuries from the BLS and CDC, it appears that Dr. Hanvey classified too many injuries as MSD injuries.⁵⁴ As clarified by the CDC, the BLS definitions exclude slips, trips, falls, and jumps as MSD injuries. In Exhibit 6, Dr. Hanvey coded a jump from a burning truck and a slip in mud as MSD injuries. Additionally, an injury described as a knee going out while in the shower was coded as an MSD injury. This injury involved one of the largest workers' compensation costs in this time period and accounts for over half of the cost in 2013 reported in Figure 1 of the Hanvey report. From the email correspondence between CRT and DCI, it appears that CRT does not consider these injuries as the type that their test can predict.⁵⁵ Again, the evidence of the relationship between the implementation of the CRT test and injuries depends on who coded the data. When data that CRT coded as relevant to their test are used, there is no relationship between the CRT test and injuries. There is only a relationship when the non-experts in MSD injuries code the data. This calls the credibility of any validity evidence presented by DCI Consulting or Dr. Hanvey into question.

For a number of the injuries included in Dr. Hanvey's analysis, it would not be possible to demonstrate validity evidence. Several of the injuries occurred when individuals were not performing the physically demanding tasks of this job. For example, one injury occurred when an employee jumped out of a truck that was on fire.⁵⁶ Another occurred while the employee was in the shower. A third occurred while an individual moved inside the truck from the driver's seat

⁵⁰ Criterion-Related Validation Study of CRT's Isokinetic Test; CRT Validation Study.PDF. Ultimately, DCI only used six of these injuries in their analyses.

⁵¹ Exhibit 6 – Hanvey Report.

⁵² See Table 24 for the Criterion-Related Validation Study of CRT's Isokinetic Test.

⁵³ See Table 24 for the Criterion-Related Validation Study of CRT's Isokinetic Test.

⁵⁴ <https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html>
<https://www.bls.gov/iif/oshdef.htm>

⁵⁵ CRT000224.pdf.

⁵⁶ Dr. Hanvey coded this as an MSD injury in his initial coding, but his colleague did not code this as an MSD injury. Hanvey Deposition, p. 143 #7; p. 144 #13-#16.

to the bunk behind the seat.⁵⁷ A fourth occurred when a driver's back hit the trailer of the truck while crawling out from under a truck.⁵⁸ Again, none of these injuries occurred while performing what were found by Dr. Hanvey to be the physically demanding tasks of the jobs. These types of injuries seem to align with what Dr. Hanvey referred to as "freak accidents" in his deposition and the type of injuries that a physical ability test could not predict.⁵⁹ CRT also considers these types of injuries as ones that their test **could not** predict.⁶⁰

The criterion of workers' compensation costs is highly contaminated

As described in the *SIOP Principles*, all criteria must be defined and documented in order to be appropriately used and interpreted. Dr. Hanvey's report does not include any specific definition or description of the workers' compensation costs criterion data that were used in the validation study. Dr. Hanvey simply notes that he was provided a data file by the defendant's counsel that he understands to include all injuries reported by Schuster truck drivers between January 2011 and January 2020.⁶¹ During his deposition, Dr. Hanvey acknowledged that he does not know what these costs actually represent or how they are computed.⁶²

This lack of understanding led Dr. Hanvey to miss the severity of the contamination in the workers' compensation data. Contamination occurs with the criterion reflects "extraneous, systematic variance."⁶³ More simply, the value of the criterion is determined by factors that are unrelated to employee behavior or ability. For example, the criterion of sales results at a car dealership would be contaminated if they included and compared sales professionals assigned to sell Ford cars and sales professionals assigned to sell BMW cars. Those selling BMWs would have higher sales results simply as a function of the difference in the sticker price of the cars. Dr. Hanvey does not describe taking any steps to ensure that the data were free of contamination.

A simple example demonstrates several of the ways in which Schuster's workers' compensation data are highly contaminated. The rates of workers' compensation payments in the State of Iowa are determined, in part, based on gross weekly wages, marital status, and the number of exemptions claimed on a tax return. At Schuster, there are differences in the amount paid per mile for employees with less than 1 year of employment, 1-2 years of employment, 2-3 years of employment, and 3 or more years of employment. Consider two employees who each drive 4,000 miles a week and each experience the same injury from lifting the hood of the truck during a pre-trip inspection (one of the more physically demanding tasks from Table 3 in Dr. Hanvey's report). Both employees are out of work for 10 weeks due to the injury. Employee A has been with the company 3 years, is married with children, and claims 4 exemptions on a federal tax return. Employee B was hired six months ago, is single, and claims 1 exemption on a federal tax return. Using information from the State of Iowa 2019-2020 workers' compensation rate book

⁵⁷ Dr. Hanvey coded this as an MSD injury in his initial coding, but his colleague did not code this as an MSD injury. Hanvey Deposition, p. 144 #3; p. 144 #13-#16.

⁵⁸ During his deposition, Dr. Hanvey acknowledges that he does not think the CRT test would predict this type of injury. Hanvey Deposition, p. 170 #1-#2.

⁵⁹ Hanvey Deposition, p. 140 #7-#11.

⁶⁰ CRT000224.pdf.

⁶¹ Hanvey Report, #66.

⁶² Hanvey Deposition p 79 #2-#6; p. 80 #1-#5; p187-188 #23-#1.

⁶³ SIOP (2018).

and the rates paid per mile driven included in the produced Schuster employee handbook, the workers' compensation payments were computed and are presented in Table 1.⁶⁴ As can be seen in the table, the costs associated with the workers' compensation for two employees performing the same job and experiencing the same injury differ by \$1,778.80 or 17.32%. The difference is unrelated to the job and physical ability. If it were the case that the CRT test was implemented in the time between when employees A and B were hired, it would appear that the use of the testing had reduced workers' compensation costs by 17%. In reality, the use of the test had no impact on the costs. The contamination in the workers' compensation cost data is producing the difference. Any claim of validity based on this difference would be erroneous.

Table 1: Workers' Compensation Payments for Two Hypothetical Schuster Employees

| Factors to Determine Workers' Compensation Payment | Employee | |
|---|-------------|-------------|
| | A | B |
| Rate Per Mile | \$0.48 | \$0.45 |
| Number of Miles Per Week | 4,000 | 4,000 |
| Gross Weekly Pay | \$1,920.00 | \$1,800.00 |
| Marital Status | Married | Single |
| Exemptions | 4 | 1 |
| Compensation Amount in the 2019-2020 Iowa Rate Book | \$1,205.18 | \$1,027.30 |
| Duration of Workers' Compensation in Weeks | 10 | 10 |
| Total Workers' Compensation Payment | \$12,051.80 | \$10,273.00 |

This simple illustration considers only a few of the many factors that impact the costs of workers' compensation and make it a contaminated criterion. Other potential contaminants in workers' compensation costs are the type of costs/expenses (e.g., medical, salary), claims that are closed or ongoing, and realized or expected costs. They are also influenced by the nature of the injury (e.g., permanent or temporary, partial or total disability), settlement process, participation in vocational rehabilitation, the state the claim is filed in, whether a lawyer is involved, and type of claim.⁶⁵ By and large, these factors are unrelated to the behavior of the employee or the physical abilities of the employee.

Although Dr. Hanvey's report is missing most this information, I was able to review some of this information for injuries occurring between January 2017 and January 2020 using the documents provided to me.⁶⁶ From this review, it is clear that the cost figures in this timeframe are a mix of open and closed claims as well as actual and expected costs. Of the injuries in this time period that Dr. Hanvey classified as MSD injuries, 4 of them were still open. Therefore, the accuracy of the costs presented in Figure 1 of Dr. Hanvey's report and the interpretations based on them are unknown until those claims close and the estimated costs are replaced with the actual costs.

⁶⁴ <https://www.iowaworkcomp.gov/ratebook>

Schuster 0002433.PDF, p. 84.

⁶⁵ https://www.iowaworkcomp.gov/sites/authoring.iowadivisionofworkcomp.gov/files/00-0026%20Workers%20Compensation%20Question%20and%20Answers%20Brochure%202019_06%20Color%20July%202019%20update.pdf

⁶⁶ Schuster 2408-2410 – Hanvey_0000017.PDF.

Given that Dr. Hanvey did not take into account any of these factors, there is no way to know if the supposed decreases in workers' compensation costs that he reports are a function of a contaminated criterion or the CRT test. As the example in Table 1 demonstrates, a non-trivial part of any difference in workers' compensation costs has nothing to do with the use of the CRT test.

The Relationship Between the CRT Test and Important Work Behaviors and Outcomes at Schuster Has Not Been Demonstrated

Both the *Uniform Guidelines* and the *SIOP Principles* describe the requirements for drawing sound inferences and the technical requirements for a criterion-related validation study to be feasible. In terms of sound inference, the *SIOP Principles* state,

“Primary consideration should also be given to the general requirements of sound validity inferences, including measurement reliability and validity, representative samples, appropriate analysis techniques, and appropriate statistical and design controls over plausible confounding factors.” (p. 11).

The *Uniform Guidelines* offer guidance on several technical requirements of criterion-related validity studies.

“Users choosing to validate a selection procedure by a criterion-related validity strategy should determine whether it is technically feasible (as defined in section 16) to conduct such a study in the particular employment context. The determination of the number of persons necessary to permit the conduct of a meaningful criterion-related study should be made by the user on the basis of all relevant information concerning the selection procedure, the potential sample and the employment situation.” (Section 14B(1))

The *SIOP Principles* provide additional guidance,

“The availability of appropriate criterion measures, the availability and representativeness of the research sample, and the adequacy of statistical power are very important in determining the feasibility of conducting a criterion related study. Depending on their magnitude, deficiencies in any of these considerations can significantly weaken a criterion-related validation study.” (p. 15).

Dr. Hanvey conducted a local criterion-related validity study using Schuster’s workers’ compensation costs from January 2011- January 2020. Using these data, he constructs a graph of the total costs each year and then interprets the pattern to indicate that the implementation of the CRT test caused the supposed decrease in the workers’ compensation costs and therefore is valid. To be clear, Dr. Hanvey’s opinion that there is validity evidence is based on a “visual inspection” of a graph, not a statistical analysis.

This opinion is flawed for several reasons that I describe in this section of the report. As described in the previous section, the workers’ compensation cost data are not credible and are highly contaminated. No sound inferences can be drawn from these data. Additionally, the local criterion-related validity study conducted by Dr. Hanvey does not meet many of these requirements for sound validity inferences including that the sample size is too small to permit any meaningful conclusions about validity and the reliability of the predictor or criterion were not considered to name a few examples. More importantly, a careful examination of the data finds that the patterns Dr. Hanvey claims support his validity argument do not exist, the patterns

depend on manipulating the data, and the patterns he observed are most likely due to factors other than the CRT test.

The observed pattern in the data is logically inconsistent with the pattern that should be observed if the CRT test were valid for reducing injuries and workers' compensation costs

If the CRT test was a valid selection procedure for reducing truck driver MSD injuries at Schuster, one would expect to see a decrease in the number of MSD injuries over time as an increasing percentage of the Schuster workforce would have taken and passed the CRT test, and therefore, are less injury prone. One would not expect a large reduction in injuries immediately as the majority of Schuster employees had not taken the CRT test right after it was implemented. The other pattern that one would expect to see is that the majority of the MSD injuries involve employees who were hired before the test was implemented.

The data show the exact opposite of the expected pattern if the test were valid. Table 2 presents the number of MSD injuries as coded by Dr. Hanvey over time and the number of injured employees who took the CRT test.⁶⁷ As can be seen, the number of MSD injuries is actually increasing after the implementation of the CRT test. In 2019 alone, there were almost as many MSD injuries as there were in 3.5 years before the CRT test was implemented. Also, the number of MSD injuries occurring for employees who passed the CRT test is increasing, not decreasing. This is clearly not the pattern that should be observed if the CRT test were valid at Schuster.

Table 2: Number of MSD Injuries and Completion of the CRT Test Pre-Hire

| Implementation of the CRT test | Year | MSD Injuries as Coded by Dr. Hanvey | Number of MSD Injuries for Employees who Took the CRT Test Pre-Hire |
|--------------------------------|--------------------|-------------------------------------|---|
| Pre CRT | 2011 | 2 | ---- |
| | 2012 | 2 | ---- |
| | 2013 | 3 | ---- |
| | January-May 2014 | 0 | ---- |
| Post CRT | June-December 2014 | 2 | 0 |
| | 2015 | 0 | 0 |
| | 2016 | 0 | 0 |
| | 2017 | 1 | 1 |
| | 2018 | 3 | 2 |
| | 2019 | 6 | 5 |

A final point is that Dr. Hanvey's presentation and interpretation of his Figure 1 is premised on the idea that those hired before the CRT test was implemented are a baseline group for workers' compensation costs when no physical ability test is used in hiring. However, this premise is not true at Schuster. Prior to the implementation of the CRT test, Schuster was using a different physical ability test. This means that the employees hired before the implementation of the CRT test were already screened on their physical abilities and, in all likelihood, have a higher average

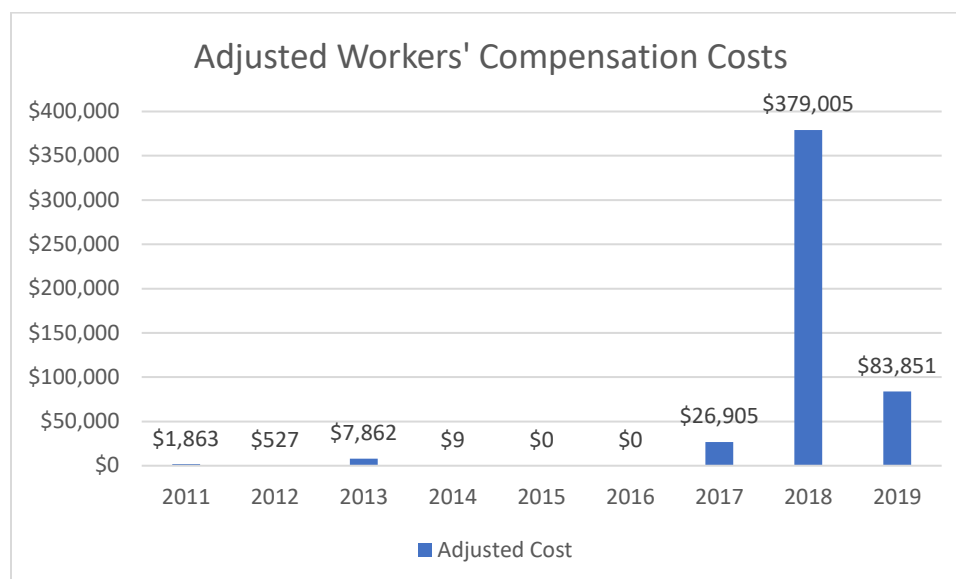
⁶⁷ There was only one month and one injury included in the data for 2020. The year 2020 is excluded from this table.

level of physical abilities than a true baseline group. Dr. Hanvey does not acknowledge that a different test was in place before the CRT test and interprets his Figure 1 as if there was no physical ability testing in place. The fact that physical ability testing was already occurring and that some of the test components resembled tasks of the job combined with the fact that injuries at Schuster are low by industry standards, it is unlikely that replacing the old test with another physical ability test would lead to the substantial reduction in injuries and workers' compensation costs that Dr. Hanvey claims have occurred.

The supposed validity evidence depends on manipulations of which injuries are included in the graph

The primary basis for claiming validity evidence from Figure 1 in Dr. Hanvey's report is that there were unusually high workers' compensation costs in 2013 and no workers' compensation costs in 2014 to 2016. This pattern is not based on the CRT test, but it is based on manipulating which injuries were included or excluded in the graph. Dr. Hanvey excludes 4 MSD injuries because these truck drivers were hired after 2014, but they did not take the CRT test pre-hire. These truck drivers should be included as they experienced MSD injuries and incurred workers' compensation costs similar to other employees who were hired prior to 2014 and did not take the CRT test. Additionally, Dr. Hanvey includes 5 injuries that do not appear to be MSD injuries (i.e., jumping from a burning truck, knee going out in the shower, foot slips in mud, hit back on truck, and knee goes out while getting out of driver's seat). If one were to add back those 4 MSD injuries and remove the 5 injuries that are not MSD injuries, a completely different picture emerges. Figure 1 presents these adjusted workers' compensation costs.⁶⁸ This pattern paints a very different picture and does not suggest that the implementation of the CRT test leads to a decrease in workers' compensation costs. The costs actually look like they have increased. Much like the evidence included in the DCI Consulting validation report, the claims of validity hinge on which specific injuries are included in the analysis.

⁶⁸ The employee whose back struck the truck did not compete the CRT test pre-hire and was excluded from Dr. Hanvey's Figure 1 and my Figure 1.

Figure 1: Adjusted Workers' Compensation Costs 2011-2019

Easily identifiable alternative explanations for the supposed pattern in the data were not considered

Dr. Hanvey states that his validation approach is an example of an interrupted time series design.⁶⁹ Dr. Hanvey correctly notes that with these types of designs one must rule out alternative explanations for the observed pattern before concluding that the intervention was the cause of any changes in the data after it was implemented. Dr. Hanvey notes that he talked to a few Schuster employees and asked them if there were any changes since 2011. They could not think of any major changes. They only identified gradual changes in equipment and looking for ways to improve safety. Based on this information, Dr. Hanvey concluded that there were no alternative explanations.

This effort to identify alternative explanations is insufficient and leads to easily identifiable alternative explanations being overlooked. As previously discussed, the criterion of workers' compensation claims is highly contaminated, and the workers' compensation costs are largely determined by factors that are unrelated to the physical capabilities of the employee or the implementation of the CRT test. This is a clear alternative explanation to any conclusion offered about the validity of the CRT test.

There is a long list of other alternative explanations for the patterns that Dr. Hanvey reports. Based on a simple Internet search of changes in the trucking industry over time, it is clear that there were many changes that could impact the number of injuries, the reporting of injuries and their associated workers' compensation costs.⁷⁰ For example, between 2013 and 2016 there were considerable changes related to truck driver working hours (i.e., "restart"). The rule essentially

⁶⁹ Hanvey Report p. 32.

⁷⁰ <https://www.ttnews.com/articles/decade-ups-and-downs-trucking>

extended truck drivers' rest time. Given that MSD injuries are caused by overexertion and repetitive tasks (e.g., daily exposure to whole body vibration that comes from driving a truck), extended rest may lead to a reduction in these types of injuries. Research finds that a lack of rest is a primary risk factor of injuries for truck drivers.⁷¹ The data seem consistent with this idea (see Table 2). The number of MSD injuries drop when the revised "reset" rules are in place for 2014-2016 and increase in 2017 when the rules are repealed. In the language of the Shadish, Cook, and Campbell book that Dr. Hanvey cites, history threats have not been ruled out.⁷²

Similarly, data from the BLS shows a national declining trend in MSD injuries between 2011 and 2018. For example, the BLS reports over 39,000 fewer MSD injuries that required days off work in 2018 compared to 2011.⁷³ Table 3 replicates these data from the BLS focusing on just injuries from sprains, strains, and tears which are primary types of MSD injuries.⁷⁴ During the time period when the CRT test was implemented at Schuster, we would have expected decreases in the number of injuries and ultimately workers' compensation costs simply because of the national trends. Even if the CRT test was not implemented, the injuries and associated workers' compensation costs were likely to have decreased. Also, over this time period, there were gradual changes in workers' compensation rules that made filing claims more difficult.⁷⁵ In the language of the Shadish, Cook, and Campbell book that Dr. Hanvey cites, maturation threats have not been ruled out.⁷⁶

Table 3: Bureau of Labor Statistics Data on Sprain, Strain, and Tear Injuries 2014-2018

| Year | Nature of injury or illness | Incidence rate per 10,000 full-time workers | Percent Decline from Prior Year |
|------|-----------------------------|---|---------------------------------|
| 2014 | Sprains, strains, tears | 38.9 | ---- |
| 2015 | Sprains, strains, tears | 38.0 | -2.31% |
| 2016 | Sprains, strains, tears | 36.3 | -4.47% |
| 2017 | Sprains, strains, tears | 35.0 | -3.58% |
| 2018 | Sprains, strains, tears | 34.0 | -2.86% |

As Dr. Hanvey notes there were continual improvements in equipment and work safety (e.g., automating physically demanding tasks such as pulling the 5th wheel pin to disconnect the trailer, reducing the amount of unloading drivers must do, adding trucks with automatic transmissions and driver safety technology). As noted in the deposition of Mr. Jeffrey Arens who holds the title of Vice President and Chief Operating Officer at Schuster, these changes were being put in place

⁷¹ Sieber, W. K., Robinson, C. F., Birdsey, J., Chen, G. X., Hitchcock, E. M., Lincoln, J. E., Nakata, A., & Sweeney, M. H. (2014). Obesity and other risk factors: the national survey of US long-haul truck driver health and injury. *American journal of industrial medicine*, 57(6), 615-626.

⁷² Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin.

⁷³ <https://www.bls.gov/iif/oshwc/case/msds.htm>

⁷⁴ Chart 13 at <https://www.bls.gov/iif/soii-chart-data-2018.htm>

⁷⁵ <https://www.dol.gov/sites/dolgov/files/OASP/files/WorkersCompensationSystemReport.pdf>

⁷⁶ Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002).

at the same time as the CRT test and were expected to make the job less physically demanding.⁷⁷ The cumulative impact of these various changes was not considered by Dr. Hanvey in any depth despite the fact that many of sources that Dr. Hanvey cited are clear that these types of changes are a major confound that limits conclusions about the validity of a selection procedure.⁷⁸ Again, maturation threats have not been ruled out.⁷⁹

Criteria such as injuries are generally underreported by employees. A variety of research funded by the BLS finds widespread underreporting even for visually obvious injuries such as loss of limb.⁸⁰ In a report on the state of the workers' compensation system, the BLS notes that underreporting has likely increased over time due to a variety of legislation that has made it more difficult to receive benefits and reduced the benefits as well as concerns over repercussions for filing a claim.⁸¹ This latter concern is important as a large change in employment practices, such as the implementation of a new physical ability test to reduce workers' compensation costs, may signal a change in treatment of employees who are injured on the job and may have had an impact on employees' willingness to report injuries. The pattern in the injury reporting data at least raise this possibility. Using the data in Dr. Hanvey's Exhibit 6, I computed the number of injuries of any kind reported between 2011 and 2019.⁸² Table 4 presents these data. As can be seen in the table, there is a decrease in reported injuries right before and shortly after the implementation of the CRT test.⁸³ However, the reported injuries increase over time.

⁷⁷ Arens Deposition, p. 140-141 #16-#14.

⁷⁸ Gebhardt, D. L., & Baker, T. A. (2010a) note that injury variables are "confounded with other safety initiatives implemented concurrently with the testing by an organization." (p. 286).

⁷⁹ Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002).

⁸⁰ Rosenman, K. D., Kalush, A., Reilly, M. J., Gardiner, J. C., Reeves, M., & Luo, Z. (2006). How much work-related injury and illness is missed by the current national surveillance system? *Journal of Occupational and Environmental Medicine*, 48(4), 357-365.

Boden, L. & Ozonoff, A. (2008). Capture-recapture estimates of nonfatal workplace injuries and illnesses. *Annals of Epidemiology*, 18, 500-506.

Ruser, J. W. (2008). Examining evidence on whether BLS undercounts workplace injuries and illnesses. *Monthly Labor Review*, 20-33.

Wiatrowski, W. J. (2014). The BLS survey of occupational injuries and illnesses: A primer. *American Journal of Industrial Medicine*, 57, 1085-1089.

Spieler, E. A. & Wagner, G. R. (2014). Counting matters: Implications of undercounting in the BLS survey of occupational injuries and illnesses. *American Journal of Industrial Medicine*, 57, 1077-1084.

⁸¹ <https://www.dol.gov/sites/dolgov/files/OASP/files/WorkersCompensationSystemReport.pdf>

⁸² The year 2020 was excluded because only one injury was reported and at the beginning of January suggesting that little of the 2020 data was included in the Schuster database.

⁸³ In the 2011 through May 2014 timeframe, there was an alternative physical ability test in place. The decreases in injuries are not likely attributable to the old test as it had been in place for some time and point to other factors that were responsible for the changes in injuries before and after the CRT test was implemented.

Table 4: Total Number of Injuries at Schuster 2011-2019

| Implementation of the CRT test | Year | Total Number of Reported Injuries |
|---------------------------------------|--------------------|--|
| Pre CRT | 2011 | 11 |
| | 2012 | 10 |
| | 2013 | 8 |
| | January-May 2014 | 4 |
| Post CRT | June-December 2014 | 4 |
| | 2015 | 4 |
| | 2016 | 2 |
| | 2017 | 6 |
| | 2018 | 5 |
| | 2019 | 18 |

I am not suggesting that any of these alternative explanations are the sole cause of the pattern in the data or that they are the only possible alternative explanations. Many other alternative explanations are possible (e.g., regression to the mean). I am simply illustrating that a serious consideration of alternative explanations easily identifies viable alternative explanations that are more likely to have caused the pattern of the data than the CRT test. The numerous alternative explanations rule out the possibility of claiming that the CRT test was the cause of any changes in workers' compensation costs that occurred.

Schuster's Passing Score on the CRT Test Has Not Been Justified

In addition to considering the validity evidence in support of a selection procedure, it is important to consider how the selection procedure is used. Schuster uses the CRT test as a pass-fail selection procedure for truck drivers with a passing score of 151. Drivers who take the CRT test at Schuster have already received a conditional offer of hire and have that offer revoked if they fail the CRT test. As described in the *Uniform Guidelines*, it is important to consider the appropriateness and evidence supporting the established passing score. On physical ability tests, in particular, it is critical to examine the evidence in support of a passing score given the potential for a passing score to create adverse impact against females. The scientific literature provides clear advice on how to establish passing scores for physical ability tests.

“Physical test passing scores should be reasonable and consistent with the demands of the job. Due to differences in physiological makeup, women may perform physical tasks differently than men do while achieving successful job performance. The key is to determine the test scores at which an individual will not perform effectively and safely.” (p. 182)⁸⁴

This guidance is particularly sound when considering the nuances in the findings about gender differences on physical ability tests from the scientific literature. The research finds score differences between men and women on some, but not all physical ability tests.⁸⁵ However, the research also finds that woman can perform physically demanding tasks at the same level of effectiveness as men, but with less physical force.⁸⁶ Based on this research, simply using measures of the physical force applied to complete a task from men would be an insufficient approach to setting or justifying a passing score and will almost certainly lead to adverse impact against women. The evidence presented in Dr. Hanvey's report does not follow this advice and therefore fails on several fronts.

First, the claims of support for Schuster's passing score are based on insufficient data and a lack of input from female truck drivers. In attempting to support the current passing score on the CRT test, Dr. Hanvey observed a male subject matter expert (“SME”) performing what were identified as the physically demanding tasks of the job. **No** female truck drivers were observed as part of the job analysis. This is a serious flaw in attempting to justify the passing score on the CRT test. It is also a puzzling choice given that this matter involves claims about the impact of the CRT test on female conditional hires. A well-designed job analysis in this situation would have focused on how male and female truck drivers do the job to understand if there are differences in how they perform physically demanding tasks. It is well known and described in several of the sources which Dr. Hanvey relied on in forming his opinion that men and woman may perform physically demanding tasks differently.⁸⁷ These differences have implications for level of physical abilities that may be needed to perform these tasks.

⁸⁴ Gebhardt, D. L., & Baker, T. A. (2010b).

⁸⁵ Courtright, S. H., McCormick, B. W., Postlethwaite, B. E., Reeves, C. J., & Mount, M. K. (2013).

⁸⁶ Jamnik, V.K., Thomas, S.G., Burr, J.F., & Gledhill, N. (2010).

⁸⁷ Gebhardt, D. L., & Baker, T. A. (2010b).

In addition to observing the male SME perform the tasks, Dr. Hanvey performed the tasks as well. While he performed them, he measured the amount of force that he personally applied when performing these tasks using a dynamometer which is a device used to measure force. Using measures of physical force to establish passing scores can be an appropriate approach.⁸⁸ However, it would require collecting measures from multiple Schuster truck drivers performing the tasks and that the truck drivers were representative of the Schuster truck driver population (e.g., in terms of age, gender, tenure). Dr. Hanvey did the exact opposite. He collected physical force data from a single male (i.e. himself) who is not a Schuster truck driver. **No** measurements were taken of the physical force applied by female truck drivers when performing these tasks. The scientific research has found that women can complete physically demanding tasks using less physical force than men.⁸⁹ For example, men may rely solely on upper body strength to complete a task. Women may rely on their whole body or combinations of muscle groups (e.g., arm and leg strength) to complete the same task.⁹⁰ It is not possible to argue that the passing score is appropriate without considering the possibility that females (or any other truck driver at Schuster) may perform the physically demanding tasks differently and may successfully complete these tasks using less physical force. The lack of physical measurements from a sample of female and male truck drivers at Schuster is a fundamental flaw in the attempts to justify the passing score. No conclusions can be drawn about the amount of force that Schuster truck drivers would use since no data was collected from them.

Second, the passing score should be set based on the lowest level of physical force exerted by employees who can perform the physically demanding tasks at a minimally acceptable level. My review of the data on current Schuster truck drivers indicates that there are a number of them performing the trucker driver job at Schuster for some time who do not pass the CRT test at the current passing score of 151. This is because Schuster administers the CRT test to incumbent drivers every 4 years, but does not take any action against incumbent drivers who fail the test. If current employees can perform the job at a minimally acceptable level, but not pass the CRT test, the passing score on the CRT test is too high.

Third, based on his job analysis, Dr. Hanvey concludes that the physical demands of the truck driver job at Schuster are similar to those of other trucking companies. If that is true, it is unclear why Schuster would need a passing score that is higher than other trucking companies using the CRT test. Given that the passing score is determined by the strength category of the job, the job is different at Schuster if the passing score is higher. The accuracy of the job analysis data that Dr. Hanvey used as part of his similarity argument is questionable. For example, 40% of the job analysis data collected by Dr. Hanvey was discarded as bad data because the employees responded in certain ways on certain items or missed directions on some specific items.⁹¹ If this much data were bad due to detectable problems, how much is bad for undetectable problems? Given that the results are not different when just the “good” data are included and when the

⁸⁸ Gebhardt, D. L., & Baker, T. A. (2010a).

⁸⁹ Jamnik, V.K., Thomas, S.G., Burr, J.F., and Gledhill, N. (2010). Construction, validation, and derivation of performance standards for a fitness test for correctional officer applicants. *Applied Physiol. Nutr. Metab.* 35(1), 59–70.

⁹⁰ Anderson & Briggs (2008).

⁹¹ Hanvey report, p. 16 #35 – p. 17 #36.

“good” and “bad” data are included, it does raise questions about the overall quality of the job analysis data.

Fourth, the process for establish the passing BIS involves taking measurements of the force required to perform the physically demanding tasks. Those measurements are then compared to the Department of Labor (“DOL”) strength levels. Then the DOL strength levels are compared to a table from CRT that claims to show the correspondence between the DOL strength level and the BIS. The process of setting the passing score on the CRT test is indirect and relies on the accuracy of the correspondence between the BIS and the DOL strength levels. At this point, no one from CRT has been able to articulate how the correspondence between the BIS and DOL strength levels was determined or its accuracy. The link between the DOL strength levels and the BIS is an unknown. To set a BIS passing score, one basically needs to trust the information from CRT and hope that it is accurate. This is inconsistent with professional practice guidelines. The *Uniform Guidelines* state:

“If the selection procedure is used with a cutoff score, the user should describe the way in which normal expectations of proficiency within the work force were determined and the way in which the cutoff score was determined (essential).” (15B(10))⁹²

The *APA Standards* state:

“When proposed score interpretation involve one or more cut scores, the rationale and procedures used for establishing cut score should be documented clearly.” (Standard 5.21).⁹³

Simply relying on information from a test vendor without critically evaluating the information is not considered acceptable professional practice. Not only did Dr. Hanvey simply accept the test vendor’s claim, he did not even know how the BIS was calculated at the time of his report and deposition.⁹⁴ It is hard to understand how an expert can justify a passing score without knowing how the score is computed or how the process for translating force measurements into a BIS works. Without information of how the correspondence between the DOL strength levels was determined, it is not possible to set a passing score on the CRT test that meets professional practice standards.

As a general issue, there is no evidence that the physical force measurements taken by Dr. Hanvey are accurate. An accurate measurement would require that the physically demanding tasks were performed using the proper technique. Dr. Hanvey does not know if he used proper technique when taking the measurements.⁹⁵ Also, it is unclear how a dynamometer was used to determine the physical force for some of the tasks. For example, a dynamometer is useful for activities involving pushing or pulling. How were accurate measurements taken on an activity that involves rotating a crank that does not have pushing or pulling? Also, how is it that getting

⁹² EEOC (1978).

⁹³ APA (2014).

⁹⁴ Hanvey Deposition p. 64 #1-4.

⁹⁵ Hanvey Deposition p. 91 #18-#23.

into and out of the truck cab involved the same amount of force by Dr. Hanvey?⁹⁶ Gravity alone would make getting into the cab more effortful than getting out of the cab. Again, this is a situation where one would need to simply trust that the measurements are accurate given the lack of information about how these measurements were taken.

⁹⁶ See Table 3 of the Hanvey Report.

Is the use of the CRT Isokinetic Test Necessary at Schuster?

Two fundamental questions related to the use of a selection procedure are 1) is it necessary and 2) are there better alternatives? This translates into the determination of the business necessity of a selection procedure and if there are alternatives that may better meet those needs (i.e., equally or more effective with less impact). Neither Dr. Hanvey nor I can offer an opinion about the business necessity of the CRT test as that is a decision for a fact finder. However, we can provide information and evidence that a fact finder can evaluate when making this decision and offer alternatives. In this case, there are several critical questions to ask that may be useful for this evaluation.

Is there a high level of injuries at Schuster?

While no employer or employee wants workplace injuries to occur, they are unavoidable in physically demanding jobs. It is expected and reasonable that employers would look for ways to keep them to minimum. As noted throughout this report, Schuster was taking a variety of steps to keep injuries at minimal levels. This raises questions about whether or not those steps were effective and was the level of injuries so high that it could justify a selection procedure with substantial adverse impact against females. In other words, was there a big problem that needed a solution regardless of the cost?

To answer this question, BLS data industry averages for general freight trucking are a useful comparison point. For employers with at least 250 employees in general freight trucking (NAICS 484100) in 2018, the BLS estimates an average incident rate of 4.4 injuries per 100 full time employees, per year. Employers in this group who have some of fewest injuries (bottom 25% of the injury distribution) have an estimate of 2.8 injuries per 100 full-time employees.⁹⁷ Using these numbers for an employer with approximately 300 truck drivers, it would be expected to observe approximately 8 injuries per year on average at the safest employers in this industry (bottom 25%). Over a 9-year period, one would expect approximately 72 injuries. From 2011-2019, there were a total of 72 injuries at Schuster. Based on these BLS data, Schuster had some of the lowest levels of injuries in the general freight trucking industry even before implementing the CRT test. The low levels of injuries are also seen in the CRT validation report created by DCI Consulting. Regardless of whether the CRT or DCI coding of MSD injuries is used, the rate of injuries was less than 1% in that data. In a physically demanding job, that is a low injury rate. Given the generally low levels of injuries, it is unclear why a selection procedure that causes adverse impact against females and has no validity evidence would be needed. Although one injury is too many, there does not appear to be a major problem in need of a solution, especially one that harms female truck driver conditional hires at Schuster.

Why focus only on MSD injuries?

In Dr. Hanvey's data, there are a total of 73 injuries between 2011-2020. Based on his coding, 20 of these injuries are classified as MSD injuries. Even with Dr. Hanvey's coding, which classifies too many injuries as MSD, they make up approximately 27% of all injuries at Schuster over nine years. It is not clear why a selection procedure would be adopted that focuses so narrowly on a

⁹⁷ https://www.bls.gov/iif/oshwc/osh/os/qrtl1_00_2018.xlsx

type of injury that is not the predominant injury that occurs at Schuster, especially when doing so creates adverse impact against female truck driver conditional hires. Schuster was already using a physical ability test that likely captured a wider range of injuries before the CRT test was implemented. If there is a business need to reduce injuries and their costs, it would seem that approaches that are focused on a wider range of injuries would better meet that need.

Are there alternative pre-employment assessments that are equally valid, but have less adverse impact that could have been used by Schuster to reduce injuries and lower costs?

The stated reason that Schuster choose to implement a new pre-employment physical ability test was to lower injuries and workers' compensation costs. Given this reason, Schuster's choice to replace their existing physical ability test with a new one is curious given their espoused belief that personality is the cause of the vast majority of injuries. In the Schuster employee handbook, it states,

“Injury statistics indicate that people themselves cause 80% of all injuries by their own acts of carelessness.”⁹⁸

Given this belief, it is not clear why a personality measure was not chosen instead of a new physical ability test. There is evidence that personality traits reflecting carelessness are related to safety behavior and accidents.⁹⁹ Additionally, the personality trait reflecting carelessness demonstrates no consistent score differences between men and women.¹⁰⁰ In other words, personality measures would be similarly valid and have less adverse impact. Moreover, they would have far greater utility. The stated purpose of the CRT test is to identify individuals at risk for an MSD injury, which is a very narrow and limited purpose. A personality measure could be used to identify individuals at risk of accident/injury, individuals who are likely to engage in all aspects of safety behavior (i.e., not just those involving physically demanding tasks), and individuals who would perform the job more effectively overall. Personality measures would have less adverse impact on females and would be a valid predictor of a much wider range of job-relevant behaviors and outcomes.

If there is a need to verify that conditional hire truck drivers can perform the physically demanding tasks, another alternative would be to have conditional hire truck drivers perform the physically demanding tasks as part of the pre-employment process. The use of a physical ability test, such as the CRT test, only has the potential to measure physical capabilities in a vacuum. (i.e., they are not content valid). Performing well on the CRT test or at least scoring above the passing score, does not indicate that a conditional hire truck driver can perform the physically demanding tasks. Getting in and out of the truck was rated as one of the most physically demanding tasks of the job. Getting in and out of the truck is a function of strength, height, and

⁹⁸ Schuster 2452 – Hanvey_0000018.pdf.

⁹⁹ Beus, J. M., Dhanani, L. Y., & McCord, M. A. (2015). A meta-analysis of personality and workplace safety: Addressing unanswered questions. *Journal of Applied Psychology*, 100(2), 481.

Clarke, S. and Robertson, I. T. 2008. An examination of the role of personality in work accidents using meta-analysis. *Applied Psychology: An International Review*, 57: 94–108.

¹⁰⁰ Costa, P. T. Jr., Terracciano, A., and McCrae, R. R. (2001). Gender differences in personality traits across cultures: robust and surprising findings. *J. Pers. Soc. Psychol.* 81, 322–331.

Feingold, A. (1994). Gender differences in personality: a meta-analysis. *Psychological Bulletin*, 116, 429–456.

weight in addition to other physical abilities that were not considered in Dr. Hanvey's job analysis. Specifically, the amount of strength required to complete the task depends on how much one weighs and how tall one is. There could be men who could pass the CRT test at Schuster, but they are not be able to get into the truck. Likewise, there could be many women who could not pass the CRT test at Schuster, but they could get into the truck. A job simulation such as having candidates perform the more physically demanding tasks will certainly be more content valid than the CRT test and the scientific literature indicates that they can be predictive of job performance.¹⁰¹ Prior to implementing the CRT test, Schuster was using a physical ability test that simulated at least some of the physically demanding tasks of the truck driver job. The use of this type of physical ability testing is familiar to Schuster. The injury level at Schuster was already low, so the adoption of a different physical ability test was unlikely to dramatically reduce the number of injuries occurring. A job simulation of the most physically demanding tasks could be built into the existing road test that conditional hire truck drivers must complete. It could be developed so that it matches the complete/not complete nature of the job tasks (i.e., an individual can lift the hood or not, climb into the cab or not) and scored objectively.

Are there alternative approaches to reducing injuries and workers' compensation costs that might apply to current and prospective employees?

Attempting to reduce injuries and workers' compensation costs through hiring is a future-oriented strategy that takes time to produce results and one that will not apply to the current employees. When there are acute problems in organizations involving the costs associated with employee behavior, strategies that involve current employees are often adopted as they are more likely to achieve larger results and achieve them more quickly. If the spike in workers' compensation costs in 2013 prompted Schuster to take steps to reduce the costs, it is surprising that strategies involving the current truck drivers were not taken. These strategies would be more likely to have benefits in the short and long term. Also, they would not have had an adverse impact on females. Although there are many interventions that Schuster could have adopted, I will briefly mention three as examples.

Enhanced safety training on physically demanding tasks. Based on the information available to me in documents and depositions, there is limited safety training on proper procedures for performing the physically demanding tasks of the truck driver job at Schuster. My understanding is that there are some safety videos shown during new truck driver orientation and that periodic reminders about safety procedures are sent to the truck drivers. From the information available to me, it appears that none of the training is interactive or behavioral. For example, none of the training has the truck drivers practice performing the physically demanding tasks safely or provides feedback on their execution of the proper techniques for performing these tasks. Enhanced and more frequent training on performing the physically demanding tasks of the job is a strategy that has the potential to reduce accidents and injuries. The scientific literature is clear that safety training works for improving these outcomes.¹⁰²

¹⁰¹ Gebhardt, D. L., & Baker, T. A. (2010a).

¹⁰² Hofmann, D. A., Burke, M. J., & Zohar, D. (2017). 100 years of occupational safety research: From basic protections and work analysis to a multilevel view of workplace safety and risk. *Journal of applied psychology*, 102(3), 375.

Reduce the physical demands of the job. Another possible alternative strategy to reduce the injuries and costs is to reduce the physical demands of the job. For example, two of the more demanding tasks are (1) to raise or lower the landing gear to secure the vehicle and (2) pull and release the 5th wheel pin. In the thirteen months from January 2019 through January 2020, these two job tasks were associated with close to \$67,000 in workers' compensation costs. Both tasks can be automated to eliminate the physical demand. Instead of manually cranking the landing gear to raise and lower it or reaching to pull the 5th wheel pin, these tasks can be done with the push of a button. In fact, many trucks at Schuster have already automated the 5th wheel pin release. The United States Occupational Safety and Health Administration has highlighted this type of change as an example of a success story for improving worker safety and reducing injuries.¹⁰³

Incentivize wellness. Some of the primary causes of workplace injuries are health factors. For example, those who are smokers or obese are more likely to experience MSD injuries.¹⁰⁴ Therefore, interventions focused on improving the health of truck drivers is likely to reduce injuries, workers' compensation costs, health care costs, and health related missed days of work. For example, in addition to incentivizing safety and tenure as Schuster does now, incentives could be put in place for participating in smoking cessation, weight loss programs, or exercise challenges. Some of these programs would likely improve the physical abilities of truck drivers and make the job less physically demanding for them.

¹⁰³ <https://www.osha.gov/successstories/wegmans-retail-2016>

¹⁰⁴ Tsai, S.P., Gilstrap, E.L., Cowles, S.R., Waddell, L.C. & Ross, C.E. (2005). Personal and job characteristics of musculoskeletal injuries in an industrial population. *Applied Ergonomics*, 36, 535-45.

Conclusions

I was retained by the EEOC to evaluate the validity evidence supporting the use of the CRT isokinetic test at Schuster in light of the CRT test's adverse impact against female conditional hires for truck driver positions. Based on my review, I find that there is **no evidence** supporting the validity of the CRT test at Schuster for truck driver positions. The validation evidence presented by Dr. Hanvey contains numerous fundamental flaws and limitations. Consistent with professional guidelines such as the *Uniform Guidelines* and the *SIOP Principles*, these limitations do not permit conclusions that the use of the CRT test at Schuster is job-related or valid. Additionally, the evidence presented fails to support the passing score on the CRT test used by Schuster.

Charles Scherbaum

Charles A. Scherbaum, Ph.D.

11/03/2020

Date

Appendix A
Curriculum Vitae for Dr. Charles Scherbaum

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Education

- August 2003 Ph.D. Psychology, Ohio University, Athens, Ohio
 Chair: Jeffrey B. Vancouver
 Dissertation Title: “Detecting intentional response distortion on measures of the five-factor model personality: The differential person functioning approach”
- August 2001 M.S. Psychology, Ohio University, Athens, Ohio
 Chair: Jeffrey B. Vancouver
 Thesis Title: “Testing a computational goal-discrepancy reducing model of goal discrepancy creation”
- December 1997 B.S. Psychology, University of Washington, Seattle, Washington

Books

Scherbaum, C. & Shockley, K. (2015). *Methods for Analysing Quantitative Data for Business and Management Students*. London: Sage.

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- Lee, P. J., Rainone, N., Aiken, J. R., Dickson, M., Scherbaum, C., Chen, T., & Hanges, P. J. (2020). Where are they now? Re-examining the migration of I-O psychologists to business schools. *The Industrial-Organizational Psychologist*, 57(4).
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Hanges, P., Scherbaum, C., Goldstein, H., Ryan, R. & Yusko, K. (2012). I-O Psychology and Intelligence: A Starting Point Established. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 5, 189-195.

Scherbaum, C. Goldstein, H., Yusko, K., Ryan, R., & Hanges, P. (2012). Intelligence 2.0: Reestablishing a Research Program on g in I-O Psychology. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 5, 128-148.

Naidoo, L.J., Scherbaum, C.A., Goldstein, H.W., & Graen, G. (2011). A Longitudinal Examination of LMX, Ability, Differentiation and Team Performance. *Journal of Business and Psychology*, 26, 347-357.

Saari, L. & Scherbaum, C. (2011). Identified employee surveys: Potential promise, perils, and professional practice guidelines. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 4, 435-448.

Scherbaum, C. & Saari, L. (2011). Identified employee surveys: Where do we go from here?

Industrial and Organizational Psychology: Perspectives on Science and Practice, 4, 487-493.

Scherbaum, C.A., Blanshteyn, V., Marshall, E., McCue, E.A., & Strauss, R. (2011). Examining the effects of stereotype threat on individual test taking behaviors. *Social Psychology of Education*, 14, 361-375.

Scherbaum, C.A., & Vancouver, J.B. (2010). If we produce discrepancies, then how: Testing a computational process model of positive goal revision. *Journal of Applied Social Psychology*, 40, 2201-2231.

Johnson, J., Steel, P., Scherbaum, C., Hoffman, C., Jeanneret, R.P., & Foster, J. (2010). Validation is like motor oil: Synthetic is better. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 3, 305-328.

Steel, P., Johnson, J., Jeanneret, R.P., Scherbaum, C., Hoffman, C., & Foster, J. (2010). At sea with synthetic validity. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 3, 371-383.

Scherbaum, C.A., & Ferreter, J.M. (2009). Estimating statistical power and sample size requirement for organizational research using hierarchical linear models. *Organizational Research Methods*, 12, 347-367.

- Article reprinted in Vogt's (Ed.) (2011) SAGE Quantitative Research Methods (vol. 4, pp. 127-150). This collection is designed to present a representative sample of the best quantitative methods articles that have appeared in SAGE journals.

Scherbaum, C.A., & Goldstein, H. (2008). Examining the relationship between differential item functioning and item difficulty. *Educational and Psychological Measurement*, 68, 537-553.

Scherbaum, C.A., Popovich, P.M., & Finlinson, S. (2008). Exploring factors related to energy conservation behaviors in organizations. *Journal of Applied Social Psychology*, 38, 818-835.

Vancouver, J.B., & Scherbaum, C.A. (2008). Do we self-regulate actions or perceptions? A test of two computational models. *Computational and Mathematical Organization Theory*, 14, 1-22.

Scherbaum C.A., Cohen-Charash, Y., & Kern, M. (2006). Measuring general self-efficacy: A comparison of three measures using item response theory. *Educational and Psychological Measurement*, 66, 1047-1063.

Scherbaum, C.A., Finlinson, S., Barden, K., & Tamanini, K. (2006). Applications of item response theory to measurement issues in leadership research. *Leadership Quarterly*, 17, 366-386.

Scherbaum, C. A. (2005). Synthetic validity: Past, present, and future. *Personnel Psychology*, 58, 481-515.

Scherbaum, C.A., Scherbaum, K.L., & Popovich, P.M. (2005). Predicting job-related expectancies and affective reactions to employees with disabilities from previous work experience. *Journal of Applied Social Psychology*, 35, 889-904.

Vancouver, J. B., Putka, D. J., & Scherbaum, C. A. (2005). Triangulating on the goal-level effect: Experimental, computational, and correlational analysis. *Organizational Research Methods*, 8, 100-127.

Popovich, P. M., Scherbaum, C. A., Scherbaum, K. L., & Polinko, N. (2003). The assessment of attitudes toward individuals with disabilities in the workplace. *Journal of Psychology*, 137, 163-177.

Vancouver, J. B., & Scherbaum, C. A. (2000). Automaticity, goals, and environment. *American Psychologist*, 55, 763-764.

Non-Peer Reviewed Publications

Scherbaum, C. A. (2013). How 'Big' are SIOP's Data? The Industrial and Organizational Psychologist, 51, 28-31.

Scherbaum, C. A. (2014). [Review of the Mechanic Evaluation Test—Forms A1R-C, B1-C, C1-C]. In J. F. Carlson, K. F. Geisinger, & J. L. Jonson (Eds.), *The nineteenth mental measurements yearbook* (pp. 413-414). Lincoln, NE: Buros Center for Testing.

Scherbaum, C. A. (2018). [Review of the Matrigma]. In J. F. Carlson, K. F. Geisinger, & J. L. Jonson (Eds.), *The twenty-fourth mental measurements yearbook* (pp. 413-414). Lincoln, NE: Buros Center for Testing.

Book Chapters

Saari, L., & Scherbaum, C. (2020). Data Privacy and Ethical Considerations with Employee Surveys and Emerging Technologies (pp. 391-406). In B. Macey & A. Fink's (Eds.) *Employee Surveys and Sensing: Challenges and Opportunities*. American Psychological Association.

Chou, V. P., Omansky, R., Scherbaum, C. A., Yusko, K. P., & Goldstein, H. W. (2019). The use of specific cognitive abilities in the workplace. In D. McFarland (Ed.), *General and Specific Abilities*. Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Yusko, K., Aiken, J., Goldstein, H., Scherbaum, C. & Larson, E. (2018). Solving the “Quarterback Problem”: Using Psychological Assessment to Improve Selection Decisions in Professional Sports. In R. Sims' (Ed.) *Human Resources Management Issues, Challenges and Trends: “Now and Around the Corner”*. Information Age Publishing.

Scherbaum, C.A., & Pesner, E. (2018). Power Analysis for Multilevel Research. In S. Humphrey & J. LeBreton's (Eds.) *The Handbook for Multilevel Theory, Measurement, and Analysis*. American Psychological Association.

- Larson, E., Yusko, K., Goldstein, H., Scherbaum, C., Aiken, J., and Oliver, L. (2018). Modernizing Intelligence in the Workplace: Recent Developments in Theory and Measurement of Intelligence at Work. In V. Zeigler and T. Shackelford (Eds.), *The Sage Handbook of Personality and Individual Differences: Applications of Personality and Individual Differences* (pg. 568-587). Thousand Oaks, CA: Sage Publications.
- Scherbaum, C., DeNunzio, M., Oliveira, J. & Ignagni, M. (2017). Race and Cultural Differences on Predictors Commonly Used in Employee Selection and Assessment. In B. Passmore, H. Goldstein, & E. Pulakos' (Eds.) *The Handbook of the Psychology of Recruitment, Selection, and Retention* (pg. 400-421). Wiley-Blackwell.
- Agnello, P., & Scherbaum, C. (2015). *Re-exploring the gender gap in mathematics: A within-person approach*. *Advances in Psychology Research* (vol 108, pp. 1-22). New York: Nova Publishers.
- Scherbaum, C. Goldstein, H., Ryan, R., Agnello, P., Yusko, K., & Hanges, P. (2015). New Developments in Intelligence Theory and Assessment: Implications for Personnel Selection. In J. Oostrom & I. Nikolaou's (Eds.) *Employee Recruitment, Selection, and Assessment. Contemporary Issues for Theory and Practice*. London: Psychology Press-Taylor & Francis.
- Scherbaum, C.A. & Saunderson, R. (2014). Using Big Data and Analytics to Create, Maintain, and Build Enterprise Engagement. *Enterprise Engagement Handbook* (pp. 215-223). New York: Enterprise Engagement Alliance.
- Sabet, J., Scherbaum, C., & Goldstein, H. (2013). Examining the potential of neuropsychological intelligence tests for predicting academic performance and reducing racial/ethnic test scores differences. In F. Metzger's (Ed.) *Neuropsychology: New Research* (pp. 1-24). New York: Nova Publishers.
- Breaux, P. & Scherbaum, C. (2013). Heroic-leadership teams: A militarily related team LMX Study. In G. Graen and J. Graen's (Ed.) *Management of team leadership in extreme contexts: Defending our homeland, protecting our first responders* (pp.1-9). Charlotte, NC: Information Age Publishing Inc.
- Scherbaum, C.A., Putka, D.J., Naidoo, L.J., & Youssefnia, D. (2010). Key driver analyses: Current trends, problems, and alternative approaches. In S. Albrecht's (Ed.), *Handbook of employee engagement*. Edward-Elgar Publishing House: Camberley, UK.
- Goldstein, H. W., Scherbaum, C. A., & Yusko, K. (2009). Adverse impact and measuring cognitive ability. In J. Outtz's (Ed.) *Adverse impact: Implications for organizational staffing and high stakes testing* (pp. 95-134). New York: Psychology Press.
- Scherbaum, C. A., & Meade, A. W. (2009). Measurement in the organizational sciences. In D. Buchanan & A. Bryman (Eds.), *Handbook of organizational research methods* (pp. 636-653). London: Sage.

Naidoo, L.J., Scherbaum, C.A., & Goldstein, H.W. (2008). Examining the relative importance of leader-member exchange on group performance over time. In G. B. Graen and J. A. Graen (Eds.), *Knowledge Driven Corporation: A Discontinuous Model. LMX Leadership: The Series* (Vol 5, pgs 211-230). Charlotte, NC: Information Age Publishing Inc.

Scherbaum, C.A., Naidoo, L.J., & Ferreter, J.M. (2007). Examining component measures of team leader-member exchange (LMX-SLX) using item response theory. In G. Graen and J. Graen (Eds.), *New Multinational Network Sharing*. Charlotte, NC: Information Age Publishing.

Scherbaum, C.A. (2005). A basic guide to statistical discovery: Planning and selecting statistical analyses. In F. Leong & J. Austin (Eds.), *The psychology research handbook: A guide for graduate students and research assistants* (2nd ed., pp. 275-292). Thousand Oaks, CA: Sage.

Austin, J. T., Scherbaum, C. A., & Mahlman, R. A. (2002). History of research methods in industrial and organizational psychology: Measurement, design, analysis. In S. Rogelberg (Ed.), *Handbook of research methods in industrial and organizational psychology* (pp. 3-33). Oxford: Blackwell Publishers.

Peer Reviewed Presentations

Kuzmich, I., & Scherbaum, C. (2020, April). *Re-examining the effect of mid-test warnings on faking on personality inventories*. Poster presented at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Natale, A., Patel, K., Scherbaum, C. A., Tumminia, A. (2020, April). *To Check or Not to Check?: Attention Checks and MTurker Attitudes & Behavior*. Poster presented at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Oliveira, J., Rutigliano, P., Scherbaum, C., & Saari, L. (2020, April). *Examining the Impact of Survey Identification on Response Behavior*. Poster presented at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Scherbaum, C. A. (2020, April). Panelist. In H. Kell (Chair). *Non-g-ocentric Models of Cognitive Abilities and Their Relevance to IO Psychology* [Session Cancelled Due to COVID-19]. Panel Discussion conducted at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Scherbaum, C. A. (2020, April). Panelist. In P. Agnello's *Synthetic Validity: An Authentic Solution to Applied Problems* [Session Cancelled Due to COVID-19]. Panel Discussion conducted at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Yusko, K., Scherbaum, C., & Goldstein, B. (2020, April). *Using Psychological Assessments to Predict Player Performance in the NFL* In H. Goldstein's *Talent Management in Elite Sports: Using an I/O Lens* [Session Cancelled Due to COVID-19]. Symposium conducted at the 35th Annual Conference of the Society for Industrial and Organizational Psychology, Austin, TX.

Yu, S., Corpuz, C., Kui, V., & Scherbaum, C. (2020, August). *Lights, Cameras, Faking: Comparing Warning Deterrents to Prevent Faking*. Poster presented at the annual meeting of the American Psychological Association, Washington, D.C.

Chou, V. P. & Scherbaum, C. A. (2019, April). *Using Cognitive Pupillometry to Study Cognitive Processes and Abilities*. In C. A. Scherbaum & P. J. Hanges (Chairs), *In the Mind's Eye: Eye Tracking as a Tool for the Organizational Sciences*. Symposium conducted at the 34th Annual Conference of the Society for Industrial and Organizational Psychology, Washington, D.C.

Chou, V. P., Scherbaum, C. A., & Hanges, P. J. (2019, April). *A Neuroscience Method to Elucidate Sources of Score Differences on Ability Tests*. Poster session presented at the 34th Annual Conference of the Society for Industrial and Organizational Psychology, Washington, D.C.

Kato, A. E., & Scherbaum, C. A. (2019, April). *Exploring the relationship between cognitive ability tilt and job performance*. In H. J. Kell & S. Wee (Co-Chairs), *Very much more than g: Further evidence for the importance of specific abilities*. Symposium conducted at the 34th annual conference of the Society for Industrial and Organizational Psychology, National Harbor.

Kuzmich, I., & Scherbaum, C. (2019, April). *Using social-categorization theory and methods to study faking behavior*. Presented at the 34th annual conference of the Society for Industrial and Organizational Psychology, National Harbor, MD.

Larson, E., Chou, V., Lee, P., Scherbaum, C., Freed, S., Pineault, L., Keval, N., Dickson, M., Aiken, J., & Goldstein, H. (2019, April). *Generalizability theory estimates of interview reliability*. Poster presented at the 34th annual conference of the Society for Industrial and Organizational Psychology, National Harbor, MD.

Lee, P. & Scherbaum, C. (2019, May). *Profiles of Individual Performance Distributions and Their Relationship with Interdependent Team Performance*. Poster presented at the European Association of Work and Organizational Psychology annual congress, Turin, Italy.

Scherbaum, C. A., & Hanges, P.J. (Chairs) (2019, April). *In the mind's eye: Eye tracking as a tool for the organizational sciences*. Symposium conducted at the Society for Industrial and Organizational Psychology Convention, Washington, DC/National Harbor, MD.

Agnello, P., Scherbaum, C., Goldstein, H., & Yusko, K. (2018, April). *Reasoning with Pseudowords in a Cognitive Ability Context*. In J. Cottrell's *What's New in Adverse Impact? Exploring Theory, Techniques, Test Types, and Tools*. Session at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Guzzo, R., Yusko, K., Goldstein, H., Scherbaum, C., Larson, E., Ryan, R., and Nalbantian, H. (2018, April). *Using Assessment to Predict Success in Sports: NFL Case Study and Panel Discussion*. Session at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Scherbaum, C., Oliver, L., Yusko, K., Goldstein, H., Agnello, P., Stahl, W., Bellenger, B., Crenshaw, J., Dawson, T., Dickson, M., Aiken, J., & Larson, E. (2018, April). *Using Job Component Validity to Hire Quickly and at Low Cost under a Consent Decree*. Poster presented at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Kato, A., Scherbaum, C., Dickson, M., Crenshaw, J., Bellenger, B., Beckman, S., Goldstein, H., & Yusko, K. (2018, April). *Examining Agreement in Job Analysis Ratings of Cognitive and Non-Cognitive KSAOs*. Poster presented at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Scherbaum, C. (2018, April). Panelist in L. Saari's *Employee Surveys and New Technologies: Privacy and Ethical Issues*. Session at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Lee, P., Aiken, J., Chen, T., Dickson, M., Hanges, P., & Scherbaum, C. (2018, April). *Re-examining the Perceived Migration of I-O Psychology to Business Schools*. Poster presented at the 33rd annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Scherbaum, C. (2017, July). Panelist in M. Dickson's *From the extreme to the norm: Transferable learnings from challenging assessment situations*. Panel discussion at the annual conference of the International Personnel Assessment Council. Birmingham, AL.

Scherbaum, C., Yusko, K., Goldstein, H., Dickson, M., Dawson, T., Allman, R., Giles, K., Agnello, P., & Stahl, W. (2017, July). *Jefferson County Job Components Validity Study*. Paper presented at the annual conference of the International Personnel Assessment Council. Birmingham, AL.

Scherbaum, C., Goldstein, H., Yusko, K., Hanges, P., Bellenger, B. (2017, July). *New Developments and Challenges in Cognitive Ability Assessment*. Symposium presented at the annual conference of the International Personnel Assessment Council. Birmingham, AL.

Nei, W., Scherbaum, C., & Velychko, G. (2017, May). *Training for success*. Poster presented at the International Convention of Psychological Science, Vienna.

Goldstein, H., Yusko, K., Scherbaum, C., Larson, E., & Ryan, R. (2017, April). *Reducing Racial Differences on Intelligence Tests for Personnel Selection*. In K. LaPort's *Alternative Measures of g: Not your grandfather's cognitive tests*. Symposium at the 32nd annual conference of the Society for Industrial and Organizational Psychology, Orlando, FL.

Mitra, P., Park, J. & Scherbaum, C. (2017, April). *Role of the Veil and Target Ethnicity in Selection Decisions*. Poster presented at the 32nd annual conference of the Society for Industrial and Organizational Psychology, Orlando, FL.

Pesner, E. & Scherbaum (2017, April). *The Influence of Task Interdependency on Intraindividual Performance Variability*. Poster presented at the 32nd annual conference of the Society for Industrial and Organizational Psychology, Orlando, FL.

Scherbaum, C. (2017, April). Panelist in R. Williams' *Practical Guidance for Developing and Implementing Ideal Point Measurement Models*. Panel discussion at the 32nd annual conference of the Society for Industrial and Organizational Psychology, Orlando, FL.

Hayrapetyan, L., & Scherbaum, C. (2016, April). *Employee Environmentally Friendly Behaviors in and out of Organizations*. Poster presented at the 31st annual conference of the Society for Industrial and Organizational Psychology, Anaheim, CA.

Scherbaum, C. (2016, April). Discussant in P. Coyle's *Measuring Leadership and Followership: Clarifying constructs and items*. Symposium at the 31st annual conference of the Society for Industrial and Organizational Psychology, Anaheim, CA.

Scherbaum, C. (2016, April). Panelist in S. Murphy's *Transforming Big and Small Data to Big Insight*. Panel Discussion at the 31st annual conference of the Society for Industrial and Organizational Psychology, Anaheim, CA.

Wilson, N., Denese, N., & Scherbaum, C. (2016, May). *Using behavioral assessments to establish construct validity of a modern cognitive ability test*. Poster presented at the Annual Conference of the Association for Psychological Science, Chicago, IL.

Yusko, K., Scherbaum, C., & Ryan, R. (2016, April). *Intelligence as a predictor of NFL performance*, In P. Hanges' *The Quarterback Problem: When Predicting Success is Difficult*. Symposium at the 31st annual conference of the Society for Industrial and Organizational Psychology, Anaheim, CA.

Oliveira, J., & Scherbaum, C. (2015, May). *Moderating Effect of Job Type on Job Characteristic-Worker Outcome Relationships*. Poster presented at the 27th APS Annual Convention, New York.

Oliveira, J., & Scherbaum, C. (2015, August). *Effect of Culture on Job Characteristic-Worker Outcome Relationships*. Poster presented at the APA Annual Convention, Toronto.

Scherbaum, C. (2015, April). Panelist in H. Goldstein's *Consulting in High Stakes Scenarios: Lessons Learned*. Panel Discussion at the 30th annual conference of the Society for Industrial and Organizational Psychology, Philadelphia.

Scherbaum, C. (2015, April). Panelist in S. Weiner's *Big Data and Identified Employee Surveys: Ethical Issues and Actions*. Panel Discussion at the 30th annual conference of the Society for Industrial and Organizational Psychology, Philadelphia.

Scherbaum, C. (2015, April). Panelist in C. Scherbaum's *Executive Board Special Session: A Data-Driven Approach to Improving SIOP: Practicing What We Preach*. Panel Discussion at the 30th annual conference of the Society for Industrial and Organizational Psychology, Philadelphia.

Agnello, P. & Scherbaum, C. (2014, May). *Re-exploring the Gender Gap in Mathematics Using a Within-Person Approach*. Poster presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Ignagni, M., Anderson, J., & Scherbaum, C. (2014, August). Beyond Mean Math Score Differences: Differential Item Functioning Within a Math Self-Concept Measure. Poster presented at the annual conference of the American Psychological Association, Washington D.C.

Mitra, P., Smith, C., & Scherbaum, C. (2014, May). *Female Managers: The Role of Implicit Attitudes and Organizational Climate*. Poster presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Ryan, R., Rothstein, J., Goldstein, H., & Scherbaum, C. (2014, August). *Immigrant Status, Test Attitudes, and Cognitive Ability Test Performance*. Poster presented at the annual conference of the American Psychological Association.

Saunderson, R. & Scherbaum, C. (2014, May). *Examining the Impact of Manager Recognition Training on Unit Performance*. Poster presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Scherbaum, C. (2014, May). Panelist in L. Saari's *Identified Employee Surveys: Complex Ethical Issues and Appropriate Actions*. Debate at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Scherbaum, C. (2014, May). Discussant in B. Gladdis' *A Critical Review of Mechanical Turk as a Research Tool*. Symposium at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Scherbaum, C. (2014, May). Future Directions for I/O research and practice using EEGs. In M.K. Ward's *Organizational Neuroscience: Using Electroencephalography (EEG) to Study I/O Topics*. Symposium presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Scherbaum, C. (2014, July). Discussant in W. Reichman's *Organizational Success Through Survey Research*, Symposium presented at the International Congress of Applied Psychology, Paris.

Smith, C., Santuzzi, A., & Scherbaum, C. (2014, May). *Perceptions of Positive Personality in Task Placement: Does Race Matter?* Poster presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Sywulak, L. Oliveira, J., Rothstein, J., Scherbaum, C., & Goldstein, H. (2014, August). *The role*

of cognitive style in performance on Raven's. Poster presented at the annual conference of the American Psychological Association.

Youssefnia, D. & Scherbaum, C. (2014, May). Using Segmentation Analysis to Drive Talent Management and Leadership Development. In L. Bousman's *The Employee Segmentation Continuum: Creating Respondent Groups to Spur Action*. Symposium presented at the 29th annual conference of the Society for Industrial and Organizational Psychology, Honolulu.

Cohen-Charash, Y., Scherbaum, C. A., Kammeyer-Mueller, J. B., & Staw, B. M. (2013, August). *Mood and the market: Can investors' collective mood predict stock prices?* The Biannual Meeting of the International Society for Research on Emotions, Berkeley, CA.

Golubovich, J. & Scherbaum, C. (2013, April). *Impact of Test Design Features on Cognitive Ability Score Differences*. Poster presented at the 28th annual conference of the Society for Industrial and Organizational Psychology, Houston.

Mellert, L., Scherbaum, C., Wilke, B., & Froelich, J. (2013, April). *Change hurts: The relationship between organizational change and financial loss*. Poster presented at the 28th annual conference of the Society for Industrial and Organizational Psychology, Houston.

Scherbaum, C. (2013, April). Panelist in L. Saari's *Identified Employee Surveys: Potential Ethical Issues and Appropriate Actions*. Debate at the 28th annual conference of the Society for Industrial and Organizational Psychology, Houston.

Scherbaum, C. (2013, April). Discussant in M.K. Ward's *Organizational Neuroscience: Classic I-O Topics, Innovative Approaches*. Symposium presented at the 28th annual conference of the Society for Industrial and Organizational Psychology, Houston.

Youssefnia, D. & Scherbaum, C. (2013, October). *Big Data, Analytics and HR: What do they have in common?* Presentation at the Northwest Human Resource Management Association Annual Conference, Tacoma, WA.

Youssefnia, D. & Scherbaum, C. (2012, October). *Harnessing the power of text analytics to drive human capital*. Presentation at Text Analytics World, Boston.

Saunderson, R. & Scherbaum, C. (2012, October). *Improving Retail Branch Performance through Employee Recognition Optimization and Analytics*. Presentation at BAI Retail Delivery Conference, Washington, D.C.

Scherbaum, C. & Goldstein, H. (2012, August). *The Evolution of Cognitive Ability Testing: Getting past g*. Paper presented at the annual conference of the American Psychological Association, Orlando, FL

Agosta, J., Diaz, C., Mir, H., & Scherbaum, C. (2012, May). *Reducing Adverse Impact Using Modern Cognitive Ability Assessments*. Poster presented at the annual meeting of the Association for Psychological Science.

Berger, Y., Denunzio, M., & Scherbaum, C. (2012, August). *Examining Immigrant-Majority Mean Score Differences on Cognitive Ability Tests*. Poster presented at the annual conference of the American Psychological Association, Orlando, FL.

Blanshteyn, V. & Scherbaum, C. (2012, April). *An item stimulus approach to understanding sources of item difficulty*. Poster presented at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Sabet, F., Scherbaum, C., & Goldstein, H. (2012, April). *Examining Criterion-related Validity and Score Differences on Neuropsychological Intelligence Tests*. Poster presented at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Scherbaum, C. (2012, April). Moderator in P. Rutigliano's *Identified Surveys: Appropriate usage and practical professional guidelines*. Debate presented at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Scherbaum, C., Hanges, P., Yusko, K., Goldstein, H., & Ryan, R. (2012, April). *The Spearman Hypothesis Cannot Explain All Racial Score Differences*. In L. Hough's Racial Differences in Personnel Selection: Complex Findings and Ongoing Research Symposium. Symposium presented at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Youssefnia, D. & Scherbaum, C. (2012, April). *Measuring Culture from the Tip of the Iceberg*. In J. Hudson's Balancing Rigor and Reality When Doing Organizational Culture Research. Symposium presented at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Yusko, K., Goldstein, H., Scherbaum, C., & Hanges, P. (2012, April). *Siena Reasoning Test: Measuring Intelligence with Reduced Adverse Impact*. Invited M. Scott Myers Award talk at the 27th annual conference of the Society for Industrial and Organizational Psychology, San Diego.

Mondo, L., Froelich, J., Youssefnia, D., & Scherbaum, C. (2011, April). *Group and Individual Level Characteristics in Predicting Survey Response Time*. Poster presented at the 26th annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Golubovich, J. & Scherbaum, C. (2011, April). *Choosing Female Managers: What Attitudes Have to Do With It*. Poster presented at the 26th annual conference of the Society for Industrial and Organizational Psychology, Chicago.

Higgs, A., Sywulak, L., & Scherbaum, C. (2011, May). *Effects of Stereotype Threat on Alternative Cognitive Tests*. Poster presented at the Annual Convention of the American Psychological Association, Washington, DC

Goldstein, H.W., Scherbaum, C.A., Yusko, K.P., Ryan, R., & Hanges, P.J. (2010, December). *Testing for Cognitive Ability with Reduced Adverse Impact: Hiring in Work Organizations*.

Presentation at the 11th Conference of the International Society for Intelligence Research, Washington, D.C.

Boyd, B. & Scherbaum, C. (2010, April). *Implicit job satisfaction*. Poster presented at the 25th annual conference of the Society for Industrial and Organizational Psychology, Atlanta.

Scherbaum, C. (2010, April). Panelist in L. Saari's *Identified Employee Surveys: Pros, Cons, What We Know/Don't Know*. Debate presented at the 25th annual conference of the Society for Industrial and Organizational Psychology, Atlanta.

Pascall-Gonzalez, R. Scherbaum, C., Ferreter, J., & Golubovich, J. (2010, April). *Examining Subgroup Differences on Cognitive Tests Using Mixed-measurement IRT Models*. Symposium presented at the 25th annual conference of the Society for Industrial and Organizational Psychology, Atlanta.

Scherbaum, C. (2010, August). Discussant in S. Ashworth's *A long-term implementation of job component validity: A 10-year follow-up*. Symposium presented at the annual conference of the American Psychological Association, San Diego.

Fisher, D. & Scherbaum, C. (2009, November). *How leadership judgment impacts performance: A practical guide for consulting psychologists*. Paper presented at the annual convention of the Illinois Psychological Association.

Fyman, J. & Scherbaum, C.A. (2009, April). *Examining the Factor Structure of Team-Member Exchange*. Poster presented at the 24th annual conference of the Society for Industrial and Organizational Psychology, New Orleans.

Naidoo, L.J., Scherbaum, C.A., & Goldstein, H.W. (2009, April). *A Longitudinal Examination of LMX, Ability, Differentiation and Team Performance*. Poster presented at the 24th annual conference of the Society for Industrial and Organizational Psychology, New Orleans.

Scherbaum, C.A. (2009, April). Panel member in C. Scherbaum & P. Steel's *Synthetic Validity: Practical Questions and Answers*. Panel Discussion at the 24th annual conference of the Society for Industrial and Organizational Psychology, New Orleans.

Blanshteyn, V., Scherbaum, C.A., Marshall, E., McCue, E.A., & Strauss, R. (2008, April). *Examining the Effects of Stereotype Threat on Individual Test Taking Behaviors*. Poster presented at the 23rd annual conference of the Society for Industrial and Organizational Psychology, San Francisco.

Cohen-Charash, Y., Erez, M., & Scherbaum, C. (2008, April). *Firgun – Being Happy for another Person's Good Fortune*. In Y. Cohen-Charash, M. Erez, M., & C. Scherbaum's (Chairs) *When Good Things Happen to Others: Envy and Firgun Reactions* symposium at the 23rd annual conference of the Society for Industrial and Organizational Psychology, San Francisco.

Ferreter, J.M., Goldstein, H.W., Scherbaum, C.A., & Yusko, K.P. (2008, April). *Reducing*

Adverse Impact using a Nontraditional Cognitive Ability Assessment. Poster presented at the 23rd annual conference of the Society for Industrial and Organizational Psychology, San Francisco.

Scherbaum, C. A. (2008, August). Discussant in J. Foster's *Synthetic validity: New directions and old questions answered*. Symposium presented at the annual meeting of the Academy of Management, Anaheim, CA.

Boyd, B. & Scherbaum, C. (2007, April). *Examining Implicit and Explicit Attitudes Towards Female Managers*. Poster presented at the 22nd annual conference of the Society for Industrial and Organizational Psychology, New York.

Kern, M. & Scherbaum, C. (2007, April). *Measuring Goal Commitment: A Comparison of Two Measures Using Item Response Theory*. Poster presented at the 22nd annual conference of the Society for Industrial and Organizational Psychology, New York.

Scherbaum, C.A. & Andreoli, N. (2007, May). *Individual difference variables and perceived fakability of the IPIP*. Poster presented at the Annual Conference of the American Psychological Society, Washington, D.C.

Scherbaum, C. & Black, J. (2007, April). *Financial and Managerial Determinants of Employee Engagement*. Paper submitted in C. Scherbaum & J. Black's (Chairs) Financial and managerial determinants of engagement symposium to the 22nd annual conference of the Society for Industrial and Organizational Psychology, New York.

Thompson, C. A., Martin, M., Poelmans, S., & Scherbaum, C. (2007). *Work-family Culture and Policies: Evidence from Spain*. Paper presented at the 2007 International Conference on Work and Family, July, Barcelona, Spain.

Ferreter, J.M., & Scherbaum, C.A. (2006, August). *A mixed measurement model analysis of the importance of intrinsic and extrinsic work rewards across cultures*. Interactive poster to be presented at the 48th Meeting of the Academy of International Business, Beijing, China.

Ferreter, J.M., Scherbaum, C.A., & Kern, M.J. (2006, May). *Examining faking on personality inventories using unfolding IRT models*. Poster to be presented at the 21st annual conference of the Society for Industrial and Organizational Psychology, Dallas, TX.

Scherbaum, C.A., & Fyman, J. (2006, May). *Influence of beliefs about team personality on team performance ratings*. Poster to be presented at the 21st annual conference of the Society for Industrial and Organizational Psychology, Dallas, TX.

Scherbaum, C., Goldstein, H. & Hayrapetyan, L. (2006, May). *Examining the relationship between differential item functioning and item difficulty*. Poster to be presented at the 21st annual conference of the Society for Industrial and Organizational Psychology, Dallas, TX.

Andreoli, N., & Scherbaum, C.A. (2005, August). *Perceived job relevance of the international personality item pool*. Poster presented at the annual conference of the American Psychological Association, Washington, D.C.

Brennan, A. & Scherbaum, C. A. (2005, June). *Item response theory: Applications and opportunities for I-O psychology*. Paper presented in F. Chiochio's (Chair), Is there a better way?: Examining a few different methods that can help generate new knowledge in I-O Psychology at the 66th conference of the Canadian Psychological Association, Montreal, Canada.

Cohen-Charash, Y., Scherbaum, C. A., Erez, M., & Bavli, K. (2005, May). *I am so happy for you: Firgun in organizations*. Paper presented at the annual meeting of the Role of Emotions in Organizational Life, Toronto, Canada.

Ferreter, J. M. & Scherbaum, C. A. (2005, August). *An examination of the measurement equivalence of importance ratings of intrinsic and extrinsic work rewards*. Poster presented at the annual meeting of the Academy of Management, Honolulu, HI.

Offenstein, J., Cohen-Charash, Y., & Scherbaum, C. A. (2005, August). *The effects of unfavorable outcomes and procedural justice on cognitive appraisals and emotions: An experimental study*. Paper presented at the annual meeting of the Academy of Management, Honolulu, HI.

Scherbaum C.A., Cohen-Charash, Y., & Kern, M. (2005, April). *Measuring general self-efficacy: A comparison of three measures using IRT*. Poster presented at the 20th annual conference of the Society for Industrial and Organizational Psychology, Los Angeles, CA.

Scherbaum, C.A., Yusko, K., Goldstein, H., & Kern, M. (2005, April). *Differential person functioning related to biodata item attributes*. Poster presented at the 20th annual conference of the Society for Industrial and Organizational Psychology, Los Angeles, CA.

Staw, B. M., Cohen-Charash, Y., & Scherbaum, C. A. (2005, June). *Emotions and the stock market*. Paper presented at the Affect and Emotions in Organizational Behavior Conference, Rotterdam, Holland.

Thomas, E., & Scherbaum, C. A. (2004, June). *The influence of implicit theories of personality on team performance ratings*. Poster presented at the 15th annual conference of the American Psychological Society, Chicago, IL.

Scherbaum, C. A. (2003, April). Panel discussant in J. B. Vancouver's (Chair) "Computational modeling of dynamic organizational phenomenon," roundtable session at the 18th annual conference of Society for Industrial and Organizational Psychology, Orlando, FL.

Scherbaum, C. A., Finlinson, S., & Vancouver, J. B. (2003, April). *Applying computational and multilevel modeling to Ackerman's skill acquisition model*. Poster presented at the 18th annual conference of the Society for Industrial and Organizational Psychology, Orlando, FL.

Scherbaum, C. A., Scherbaum, K. L., & Popovich, P. M. (2003, June). *Development and validation of the attitudes toward employees with disabilities scale*. Poster presented at the 15th annual conference of the American Psychological Society, Atlanta, GA.

Scherbaum, K. L., Scherbaum, C. A., & Popovich, P. M. (2003, June). *Sex Differences in perceptions of same-sex and opposite-sex sexual harassment*. Poster presented at the 15th annual conference of the American Psychological Society, Atlanta, GA.

Popovich, P. M., Finlinson, S., Scherbaum, C. A., Wilson, S., Hoffer, K., & Sinozich, A. (2002, April). *Exploring factors related to energy conservation behaviors in organizations*. Poster presented at the 17th annual conference of the Society for Industrial and Organizational Psychology, Toronto, Canada.

Popovich, P. M., Finlinson, S., Scherbaum, C. A., Wilson, S., Hoffer, K., & Sinozich, A. (2002, August). *Organizational energy conservation: assessing knowledge, attitudes, social norms, and behaviors*. Poster presented at the annual conference of the American Psychological Association, Chicago, IL.

Scherbaum, C. A., & Vancouver, J. B. (2002, April). *Testing two explanations for goal-setting effects: A persistent question*. Poster presented at the 17th annual conference of the Society for Industrial and Organizational Psychology, Toronto, Canada.

Scherbaum, C. A., & Vancouver, J. B. (2002, April). *Testing a computational goal-discrepancy reducing model of discrepancy production*. In J. Vancouver (Chair), Goal perception discrepancy production: Current theoretical and practical issues. Symposium paper presented at the 17th annual conference of the Society for Industrial and Organizational Psychology, Toronto, Canada.

Scherbaum, C. A., Scherbaum, K. L., & Popovich, P. M. (2001, May). *The reasonableness of accommodations for disabled workers: Perceptions of accommodations among college students*. Poster presented at the 73rd Midwestern Psychological Association convention, Chicago, IL.

Scherbaum, C. A., Scherbaum, K. L., Tischner, E., & Popovich, P. M. (2001, April). *Predicting job-related expectancies of disabled employees from previous work experience*. Poster presented at the 16th annual conference of the Society for Industrial and Organizational Psychology, San Diego, CA.

Larrimer, K. A., Scherbaum, C. A., & Popovich, P. M. (2000, June). *Attitudes towards the Americans with Disabilities Act and reasonable accommodation*. Poster presented at the 12th annual conference of the American Psychological Society, Miami, FL.

Popovich, P. M., Polinko, N., Larrimer, K. A., & Scherbaum, C. A. (2000, May). *The Americans with Disabilities Act and reasonable accommodation: Beliefs, affect, and behaviors*. Poster presented at the 72nd Midwestern Psychological Association convention, Chicago, IL.

Scherbaum, C. A., & Vancouver, J. B. (2000, June). *Discrepancy creation from discrepancy reduction: A working model*. Poster presented at the 12th annual conference of the American Psychological Society, Miami, FL.

Vancouver, J. B., Putka, D. J., & Scherbaum, C. A. (2000, August). *How control theory accounts for goal-setting: An empirical investigation*. Paper presented at the Annual Conference of the Academy of Management, Toronto, Canada.

Zollo, J. S., Scherbaum, C. A., & Vancouver, J. B. (1999, May). *Goal setting in perfect markets*. Poster presented at the 71st Midwestern Psychological Association convention, Chicago, IL.

Invited Presentations

Yusko, K., Goldstein, H., Scherbaum, C. & Larson, E. (2020, October). *Innovations in assessment*. Office of Personnel Management and Office of Budget Management's Best Practices for Modernizing Assessments.

Scherbaum, C., (2020, September). *Psychological Perspectives on Retaliation: Potential Causes and Solutions*. EEOC Technical Assistance Program Seminar – New York.

Scherbaum, C., Goldstein, H., & Yusko, K. (2019, October). *Using Psychological Assessments to Predict Player Performance in the NFL*. Society for Industrial and Organizational Psychology's Leading Edge Consortium, Atlanta.

Yusko, K., Goldstein, H., & Scherbaum, C. (2019, July). *Modern approaches to the assessment of cognitive abilities*. Presentation at the annual meeting of the International Personnel Assessment Council. Minneapolis, MN.

Yusko, K., Goldstein, H., & Scherbaum, C. (2019, June). *Moneyball Plus: Predicting Player Performance Using Psychological Assessments in Sports*. Presentation at the KPMG Sports Analytics World Series. Amsterdam.

Trindel, K. & Scherbaum, C. (2019, March). *Modern approaches to assessment for employment selection*. Featured Speaker Presentation at the annual meeting of the Association of Test Publishers. Orlando, FL.

Scherbaum, C. (2018, November). *Assessment Driven Managerial Development: Personalizing Micro Learning for Macro Results*. HRO Today Forum – EMEA. Amsterdam.

Scherbaum, C., (2018, June). *Psychological Perspectives on Retaliation: Potential Causes and Solutions*. EEOC Technical Assistance Program Seminar – New York.

Scherbaum, C. (2018, May). *Assessment Driven Managerial Development: Personalizing Micro Learning for Macro Results*. HRO Today Forum – North America. Washington, D.C.

Yusko, K., Goldstein, H., & Scherbaum, C. (2018, October). *Using Data Analytics to Identify & Hire Elite Performers in the Workplace—Lessons Learned from the NFL Combine*. Texata Summit. Austin, TX.

Yusko, K., Goldstein, H., & Scherbaum, C. (2018, March). *Moneyball Plus Predicting Player Performance Using Psychological Assessment: A Comparison Across the Major Sports*. MIT Sloan Sports Analytics Conference. Boston, MA.

Scherbaum, C. (2017, May). *Leveraging Analytics and Leadership Development to Drive Engagement Creation and Improve Business Performance*. HRO Today Forum – North America. Chicago, IL.

Scherbaum, C. (2017, November). *Celebrating Employees!: Best Practices in Recognition*. HRO Today Forum – EMEA. Dublin, Ireland.

Yusko, K., Scherbaum, C., & Goldstein, H. (2017, March). *NFL Player Assessment Test: Using Psychological Tests to Predict Player Performance in the NFL*. MIT Sloan Sports Analytics Conference. Boston, MA. https://youtu.be/40NV3_u9tYY

Scherbaum, C. (2016, March). *New Developments in Intelligence*. Invited talk at Wayne State University.

Scherbaum, C. (2016, April). *The New Frontier of Human Capital Analytics*. Enterprise Engagement Alliance Forum. Orlando, FL.

Scherbaum, C. (2016, November). *Leveraging Analytics and Leadership Development to Drive Engagement Creation and Improve Business Performance*. HRO Today Forum – EMEA. Edinburgh, Scotland.

Scherbaum, C. (2015, June). *Rethinking Intelligence: Conceptualization, Use, and Measurement*. Invited talk at the Metropolitan New York Association for Applied Psychology.

Scherbaum, C. (2015, May). *Expert Panel Discussion: Beyond the Basics – Creating Truly Healthy Office Environments*. Invited Panel Discussion at the 2015 WorkTech Conference, New York. <https://vimeo.com/channels/worktechtv/129122499>

Scherbaum, C. (2014, April). *Big Data and analytics: Unleashing the Potential of Enterprise Engagement*. Enterprise Engagement Alliance Forum. Memphis, TN.

Scherbaum, C.A. (2010, August). *Integrity testing as a strategy for reducing counter-productive work behaviors*. Invited talk to the Singapore Psychological Society, Singapore.

Scherbaum, C.A. (2009, November). *Synthetic validity: An introduction to useful, but unused approach to establishing validity evidence*. Invited talk at the Fall conference of Mid-Atlantic Personnel Assessment Consortium, Albany, NY.

Scherbaum, C.A. (2009, April). *What roles do employee honesty and integrity play within the human factor concept?* Invited talk at Risk Talk series of the Swiss Re Centre for Global Dialogue, Zurich.

Scherbaum, C.A. (2007, October). *Introduction to techniques for detecting faking on non-cognitive employment measures.* Invited talk at the Fall conference of Mid-Atlantic Personnel Assessment Consortium, Albany, NY.

Scherbaum, C.A. (2007, May). *Applications of item response theory to personnel assessment: Introduction and overview.* Invited talk at the spring conference of Mid-Atlantic Personnel Assessment Consortium, Harrisburg, PA.

Scherbaum, C.A. (2006, January). *Applications of item response theory to patient-reported data on health outcomes and behavior.* Invited talk at the National Development Research Institute, New York, NY.

Scherbaum, C.A. (2004, April). *Assessment and evaluation: Basic concepts and principles.* Presentation at the 7th annual Baruch College Teaching and Technology Conference, New York, NY.

Manuscripts and Books in Preparation & Review

Kuzmich, I. & Scherbaum, C. *Using social-categorization theory and methods to study faking behavior.* Revise and resubmit at Personnel Assessments and Decisions.

Goldstein, H., Scherbaum, C., Larson, E., & Yusko, K. *Developing a Next Generation Entry-Level Police Test: Evolving Beyond the Traditional Assessment Approach.* Special issue proposal invited for submission at review at Personnel Assessments and Decisions.

Goldstein, H., Scherbaum, C., Larson, E., & Yusko, K. Reducing Black-White Racial Differences on Intelligence Tests in Personnel Selection. Special issue proposal invited for submission at Journal of Business and Psychology.

Pineault, L., Alenick, P., Dickson, M., Scherbaum, C. Alber, M., Crenshaw, J. & Bellenger, B. *Too stressed to impress: An examination of race-based differences in the relationship between police candidate anxiety and interview performance.* Special issue proposal invited for submission at review at Personnel Assessments and Decisions.

Scherbaum, C., Kell, H., Goldstein, H., Wee, S., Lang, J., Bipp, T., Yusko, K., & Larson, E. Cognitive abilities and the modern world of work. Invited book by the International Testing Commission. Publisher – Cambridge Press.

Chou, V., Scherbaum, C., & Hanges, P. *A Neuroscience Method to Elucidate Sources of Score Differences on Ability Tests.* Manuscript in preparation.

Scherbaum, C.A., Pascall-Gonzales, R., Ferreter, J.M., Goldstein, H.W., & Yusko, K. *Examining Group Score Differences on Cognitive Ability Tests using Mixed-Measurement IRT Models.* Manuscript in preparation.

Kato, A. & Scherbaum, C. *Exploring the Relationship between Cognitive Ability Tilt and Job Performance*. Manuscript in preparation.

Kato, A., Scherbaum, C., Dickson, M., Crenshaw, J., Bellenger, B., Goldstein, H., & Yusko, K. Examining Source Differences in Job Analysis Ratings of Cognitive and Non-Cognitive Worker Attributes. Manuscript in preparation.

Larson, E., Chou, V., Lee, P., Scherbaum, C., Dickson, M., Aiken, J., Freed, S., & Goldstein, H. *Generalizability Theory Estimates of Interview Reliability*. Manuscript in preparation.
Scherbaum, C.A., Yusko, K., Goldstein, H., & Kern, M. *Differential responding to biodata items as a function of item attributes: The differential person functioning approach*. Manuscript in preparation.

Goldstein, H, Yusko, K., Scherbaum, C.A., & Larson, E. *Examining the predictive validity and adverse impact of modern cognitive abilities tests*. Manuscript in preparation.

Grant Funding

- The Influence of Implicit Theories about Team Personality Characteristics on Ratings of Team Performance. *PSC-CUNY 35*, 2004-2005, PI (\$4,480).
- Differential item functioning and item properties of standardized cognitive tests. *Eugene M. Lang Fellowship Program*, 2005-2006, PI (\$7,000).
- Detecting response distortion on non-cognitive predictors of job performance. *City University of New York Research Equipment Grants Program*, 2004, PI (\$5,450)
- Differential item functioning and item properties of standardized cognitive tests. *PSC-CUNY 36*, 2005-2006, PI (\$3,816).
- Differential item functioning and item properties of standardized cognitive tests (2005-2006). *Wonderlic, Inc.'s Research Donation Program*, PI (\$2,000)
- Examining the Effects of Stereotype Threat on Individual Test Taking Behaviors. *PSC-CUNY 37*, 2006-2007, PI (\$3,664)
- Basic and Applied Dimensions of Scientific Psychology: Research Experience for Undergraduates at Baruch College – *CUNY National Science Foundation*, PI, 2007-2010 (\$269,787)
- Examining the Impact of Explicit and Implicit Attitudes towards Female Managers. *PSC-CUNY 39*, 2008-2009, PI (\$3,285).
- Improving Graduate Business School Admissions: Supplementing the GMAT with Alternative Predictors. *MERInstitute of the Graduate Management Admissions Council*, PI, 2010-2011 (\$100,000).
- Basic and Applied Dimensions of Scientific Psychology: Research Experience for Undergraduates at Baruch College – *CUNY National Science Foundation*, co-PI, 2010-2013 (\$282,021)
- Neurocognitive measures of employee engagement. *PSC-CUNY 47*, 2015-2016, PI (\$3,500).
- Basic and Applied Dimensions of Scientific Psychology: Research Experience for Undergraduates at Baruch College – *CUNY National Science Foundation*, PI, 2019-2022 (\$335,000)

Awards:

- 2018 Adverse Impact Reduction Research Initiative and Action (AIRRIA) Research Grant from the Society for Industrial and Organizational Psychology (Project title: *Using Neurocognitive Methods to Understand Sources of Adverse Impact on Cognitive Ability Tests*).
- 2017 Innovation in Assessment Award from the International Personnel Assessment Council (Project title: *Jefferson County and Siena Consulting Job Components Validity Study*).
- 2017 HRO Today Global Forum – HR Global Superstar.
- 2017 HRO Today – Tek Tonic Award.
- 2011 M. Scott Myers Award for Applied Research in the Workplace from the Society for Industrial and Organizational Psychology. Project title: *Development and Implementation of the Siena Reasoning Test*.
- 2011 Innovation Award from the International Personnel Assessment Council (Yusko, Goldstein, Scherbaum, and Hanges; Project title: *Siena Reasoning Test*).
- Mrs. Giles Whiting Foundation Fellowship, 2005 (\$2000 to support research activities)
- Honorable mention, the Organization Development Institute's 2002 Outstanding O.D. Project of the Year Worldwide. Project title: *Exploring Factors Related to Energy Conservation Behaviors in Organizations*
- Ohio University Doctoral Fellow, 2001-2003
- Ohio University College of Arts and Sciences Outstanding Graduate Student Teaching Award, 2001-2002

Academic Experience

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|----------------------------|---|
| August 2017-Present | Professor, Department of Psychology, <i>Baruch College, City University of New York</i> , New York, NY <i>Undergraduate courses:</i> Introduction to Psychology, Industrial and Organizational Psychology, Advanced Personnel Psychology, Practicum in Lab and Research Methods <i>Master's Courses:</i> Research Methodology in the Design of Psychological Research, Psychometric Methods, Quantitative Methods for Business Decisions <i>International Executive Master's Courses (Taiwan and Singapore):</i> Psychological Perspectives on International Human Resource Management, Quantitative Methods for Business Decisions <i>Ph.D. Courses:</i> Advanced Psychometrics, Research Methods, Performance Management, Organizational Psychology |
| September 2007-August 2017 | Associate Professor, Department of Psychology, <i>Baruch College, City University of New York</i> , New York, NY |
| September 2003-August 2007 | Assistant Professor, Department of Psychology, <i>Baruch College, City University of New York</i> , New York, NY |
| Fall 2000-Spring 2003 | Instructor, <i>Ohio University, Department of Psychology</i> , Athens, OH |

Undergraduate courses: Statistics for the Behavioral Sciences, Introduction to Psychology, Survey of Industrial and Organizational Psychology

Fall 2002

Instructor, *Ohio University and Hong Kong Baptist University, School of Continuing Education*, Hong Kong
Undergraduate courses: Introduction to psychology, Survey of Industrial and Organizational Psychology

Consulting Experience

November 2008-Present

Owner, *Cielo Management Consulting, LLC*, New York, NY
 Cielo Management Consulting provides human resource management consulting services in the areas of selection and assessment, performance management, employment discrimination litigation support, human capital research, employee surveying, and statistical analysis. A sample of clients include:

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| Morgan Stanley | Root Learning |
| National Football League | Pennsylvania Power & Light |
| Hilton Worldwide | Chicago Public Schools |
| Rideau Recognition Solutions | NYC Department of Education |
| Bristol, Myers, Squibb | City of Dayton, OH |
| Merrill Lynch | Royal Bank of Canada |
| Accenture | The Medicine's Company |
| National Foreign Trade Council | Intuit |
| Glint | Wendys |
| Owens Corning | Jefferson County, AL |
| Prudential | Intel |
| Port of Seattle | Merrill Technologies |
| City of Stamford, CT | City of Akron, OH |

Expert witness consultation:

- 2005-2011 Ahroner v. Israel Discount Bank. No. 602192/03 (DNY).
 Plaintiff. Issued report, conducted statistical analyses on performance appraisal systems and termination decisions, reviewed documents.
- 2007 NTEU and FDIC Arbitration, Case# 1276. Plaintiff. Plaintiff. Provided advice to NTEU.
- 2011-2012; United States, The Vulcan Society, et al. v. City of
 2018-present New York and Uniformed Firefighters Association of Greater New York. 07-CV-2067 (NGG) (RLM)
 Plaintiff. Provided advice to the Vulcan Society on new selection tests and validation studies.

- 2009-2015 Morgan Stanley Smith Barney Consolidated Agreement (Formerly Amochaev v. Citigroup Global Markets-Smith Barney and Augst-Johnson v. Morgan Stanley). Case No. 1:06-cv-01142 (RWR) and Case No. C-05-1298 PJH (N.D. Cal). Neutral for both parties. Provided advice to Smith Barney and Morgan Stanley, reviewed change initiatives, conducted statistical analyses on selection tests.
- 2009-2015 Jaffe v. Morgan Stanley Smith Barney (Formerly Jaffe v. Morgan Stanley). Case No. C-06-3903 (THE). Neutral for both parties. Provided advice to Smith Barney and Morgan Stanley, reviewed change initiatives, conducted statistical analyses on selection tests.
- 2013 Emmer v. Trustees of Columbia University. No. 151510/2013 (DNY) Plaintiff. Issued report.
- 2012-2019 United States v. City of Dayton, Civil Action No. 3:08-cv-348 (TMR) Defendant. Provided advice to the City of Dayton, conducted test development, conducted validation studies, conducted statistical analyses.
- 2014-2016 Calibuso v. Bank of America, et al, Case No: 2:10-CV-01413(PKC)(AKT). Defendant. Conduct a study of financial advisor teaming within U.S. Wealth Management for the purpose of generating recommendations to facilitate improved teaming arrangements for women financial advisors.
- 2018 United States v. Buffalo, et al, W.D.N.Y. 74-CV-195C Plaintiff, Lawyers Committee for Civil Rights. Providing advice to the Lawyers Committee on test development, validation, and method of use.
- 2019-Present United States v. Rhode Island Department of Corrections, Civil Action No.: 1:14-cv-78(S). Plaintiff. Providing advice to the United States on test development and validation. Reviewing defendant's tests, validation, and adverse impact results.
- 2019-Present Simpson et al. v. Cook County Sheriff Department, Case No. 18 C 553 Plaintiff. Conducted adverse impact analyses, reviewed defendant's selection systems. Issued reports and deposed.
- 2019-Present Richardson et al. v. City of New York. 17-CV-9447 (JPO). Plaintiff. Conducted adverse impact analyses on compensation, hiring, and promotions systems for FDNY civilian jobs. Issued reports and deposed.
- 2020-Present United States et al. v. Consolidated City of Jacksonville, Jacksonville Association of Fire Fighters, Local 122, IAFF, Case No. 3:12-cv-451-J-32MCR. Plaintiff. Provided advice to the United States on test development and validation. Reviewing defendant's tests, validation, and adverse impact results.
- 2020-Present United States v. Baltimore County, Maryland, Civil Action No. 1:19-cv-02465.

Plaintiff. Provided advice to the United States on test development and validation. Reviewing defendant's tests, validation, and adverse impact results.

2020-Present EEOC v. Schuster, Co., Civil Action No: 5:19-cv-4063
Plaintiff. Provided advice to the United States on test development and validation. Reviewing defendant's validation reports.

2020-Present EEOC v. Stan Koch & Sons Trucking, Civil Action No: 0:19-cv-02148
Plaintiff. Provided advice to the United States on test development and validation. Reviewing defendant's validation reports.

Expert Advisory Panels:

2013-2015 United States Department of Labor. Evaluating the Accessibility of American Job Centers for People with Disabilities.

Additional Consulting Experience:

August 2007-December 2015 Research and Analytics Advisor, *Critical Metrics*, New York, NY
Design and execute custom research and analytics for employee and customer research.

August 2007-January 2014 Research and Analytics Advisor, *Fisher Rock Consulting*, New York, NY
Developed and managed research projects examining the operations of global mobility programs, human capital models, employee engagement, test validity, and performance management systems.

March 2006-January 2008 Consultant, *Sirota Survey Intelligence*, New York, NY
Conducted statistical analyses and project management of studies examining the relationships between human resource activities and financial and market performance of organizations.

January 2005-August 2005 Consultant, *Kognito Solutions*, New York, NY
Designed and conducted a program evaluation of computer-based of financial literacy tutorials, conducted review of current and existing products, advised on the design of program assessments.

May 2001-August 2001 Consultant, *Ohio University and Vestar, Inc.*, Athens, OH
Conducted focus groups, developed a survey-based intervention for Ohio University's energy conservation campaign, and conducted the follow-up evaluation of the intervention.

Work Experience

June 1998-August 1998 Lead Personnel Records Technician, *Washington Mutual, HR Operations Department*, Seattle, WA

Supervised six employees in the processing of new employees into the payroll system. Resolved problems and discrepancies for managers, recruiters, and new employees. Verified and audited records, and regulated workflow. Trained employees to use PeopleSoft and Excel.

January 1998-May 1998

Employment Assistant, *Washington Mutual, Employment Department*, Seattle, WA

Assisted recruiters and managers with staffing and recruitment policies and procedures. Audited job files for compliance with OFCCP and EEOC regulations. Maintained national staffing reports, opened and closed staffing requisitions, and trained new employees. Received advanced training in Excel and PeopleSoft.

August 1997-January 1998

Human Resource Intern, *Prudential Preferred Financial Services*, Seattle, WA

Assisted with the recruitment of new agents, conducted individual and group interviews, administered selection tests, and conducted employee surveys.

Professional Activities

2020-Present

Awards Committee, SIOP Anti-Racism Grant and Zedeck-Jacobs Adverse Impact Research Grant

2019-Present

Secretary, Northeastern Chapter of the International Personnel Assessment Council.

2016-Present

Head of the Ph.D. program in Industrial and Organizational Psychology, City University of New York.

2018-Present

Program committee for the Talent Analytics Conference, Society for Industrial and Organizational Psychology

2012-2015

Chair of the Institutional Review Committee, Society for Industrial and Organizational Psychology

2010-2011

President of the Metropolitan New York Association for Applied Psychology

2009-2010

Vice-president of the Metropolitan New York Association for Applied Psychology

2008-2009

Treasurer of the Metropolitan New York Association for Applied Psychology

2007-2008

Secretary of the Metropolitan New York Association for Applied Psychology

2009-Present

Editorial board for the *Journal of Business and Psychology*

2012-Present

Editorial board for the *Journal of Applied Psychology*

2017-Present

Editorial board for the *Organizational Research Methods*

2017-Present

Editorial board for *Industrial and Organizational Psychology*

2018-Present

Editorial board for *International Journal of Selection & Assessment*

2019-Present

Editorial board for *Personnel Assessment and Decisions*

Professional Memberships

- Members of the International Personnel Assessment Council
- Members of the International Testing Commission
- Member of the American Psychological Association
- Member of the Society for Industrial and Organizational Psychology
- Member of the Academy of Management
- Member of the Metropolitan New York Association for Applied Psychology
- National member of Psi Chi

Media Interviews and Media Coverage

- TLNT (6/5/14): “Technology Insights: How Big Data Can Help HR Drive Recognition”
<http://www.tlnt.com/2014/06/03/technology-insights-how-big-data-can-help-hr-drive-recognition/>
- BusinessWeek Online Interactive Case Study: “Maintaining Employee Engagement”
<http://www.businessweek.com/stories/2009-01-16/the-issue-maintaining-employee-engagementbusinessweek-business-news-stock-market-and-financial-advice>
- The Investment Professional: “Hive Mind: Organizational Psychology and the Origins of the Financial Crisis” http://www.theinvestmentprofessional.com/vol_2_no_2/hive-mind.html.
May 2010

Government and Legal Coverage of Research

- My research on the impact of stereotype threat was referenced in the Brief of the American Association for Affirmative Action as Amicus Curiae to the U.S. Supreme Court in support of the respondents in Fisher v. University of Texas, Austin.
- The outcomes of the Baruch College NSF-REU program were referenced in the statements of Dr. Myron P. Gutmann, Assistant Director, Social, Behavioral, and Economic Sciences at the National Science Foundation to the Committee on Science, Space, and Technology Subcommittee on Research and Science Education, United States House of Representatives on June 2, 2011.

Appendix B
Information Sources Used

In preparing this report, I relied on the following information and data sources. The sources used from the scientific literature, United States Department of Labor, United States Bureau of Labor Statistics, United States Occupational Safety and Health Administration, United States Centers for Disease Control, and State of Iowa, Division of Workers' Compensation are indicated as footnotes throughout the report.

- Dr. Chester Hanvey's Expert Report.pdf
- Dr. Erin George's Expert Report.pdf
- DCI CRT Criterion-Related Validation of CRT's Isokinetic Test.pdf
- CRT Test Manual.pdf
- Dr. Chester Hanvey's deposition
- Mr. Steve Schuster's deposition
- Mr. Jeffrey Arens' deposition
- Mr. Lamfers' deposition
- Mr. Brett Crosby's deposition
- Dr. Clifford Hayman's deposition
- Complaint.pdf
- Answer.pdf
- Answer question no. 2.pdf
- Answer to Question No. 4-paginated.pdf
- Answer to Question No. 6 - Part 1.pdf
- Answer to Question No. 6 - Part 2.pdf
- Schuster Company Employee Handbook
- First Amended Complaint.pdf
- Answer to Amended Complaint.pdf
- Defendant's First Supplemental Response to Plaintiff's Request for Production of Documents, No. 13
- Trial Management Order for Civil Bench Trial.pdf
- CRT Website: <http://costreductiontech.com/>
- O*NET - 53-3032.00 - Heavy and Tractor-Trailer Truck Drivers
- 20200701_Schuster_final.xlsx
- SchusterAnalyses.rmd
- Gary Soderberg (204). Scientific treatise on the bases, principles, validation, and protocols for isokinetic testing in the workplace.

Hanvey Production

- Hanvey_0000013.pdf
- Hanvey_0000014.pdf
- Hanvey_0000031.xls
- Hanvey_0000032.xls
- Hanvey_0000033.xls

Schuster Production

- Schuster 0002395.pdf

- Schuster 0002397.pdf
- Schuster 0002398.pdf
- Schuster 0002400.pdf
- Schuster 0002408.pdf
- Schuster 2538.pdf
- Schuster 2581.pdf
- Schuster 2603.pdf
- Schuster 2605.pdf
- Schuster 2612.pdf
- Schuster 2613.pdf

CRT Production

- CRT000024.pdf
- CRT000025.pdf
- CRT000027.pdf
- CRT000033.pdf
- CRT000083.pdf
- CRT000084.pdf
- CRT000086.pdf
- CRT000134.pdf
- CRT000139.pdf
- CRT000232.pdf
- CRT000197.pdf

DCI Production

- DCI000243.pdf